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TABLE OF CONTENTS.

The Problem of Selection in Engineering Education. A. A. Potter, President 88
Report of the Board of Investigation and Coördination of the Society. Charles F. Scott, Chairman 90
The Department of English 93
Minutes of the Meeting of the Institutional Delegates at Boulder Meeting 97
Recognition of the Individual. Carl E. Seashore 111
Problem Courses. Donald B. Prentice 123
The Engineering Problems Courses at the University of Washington and the Iowa State College. Forest C. Dana 127
Education in English for Engineering Students. Bradley and Merwin Roe Stoughton 140
Report of the Secretary for 1923–24 148
Report of the Treasurer for 1923–24 156
Charles A. Coffin Fellowships Awarded in 1924 158
B. G. Lamme's Will Aids Engineering Education 160
Book Review 161
New Members 162

THE PROBLEM OF SELECTION IN ENGINEERING EDUCATION.

BY A. A. POTTER, President.

Teachers are in a position to produce the greatest development in the individual student if their instruction is thorough and is based upon careful selection. The theory that there will be a "survival to the fittest" if applied to education, may result in spending large sums of public funds without adequate return. Instruction can be carried on most effectively if, like the selling of commodities, it is adapted to our student-customers who differ greatly in mentality, personality and preparation. The master teacher does not give standardized instruction promiscuously to his entire class, but bases his courses upon the talents of the individual student. He guides each of his students in discovering his aptitudes and how to use them. He carefully selects and tries to develop each of his students for maximum usefulness to Society.

Among the first projects to be undertaken by the faculty committees of engineering colleges in connection with their coöperative studies for the Board of Investigation and Coördination are several which are closely related to the problem of "selection." The coöperating committees are being requested to make an inquiry into student sources and characteristics as well as a study of elimination of engineering students. It is expected that these investigations will be supplemented by experiments with placement examinations, diagnostic studies of the causes of failure, and a critical analysis of the present status of educational guidance. The faculty committees will also be invited to make a study of the careers of engineering graduates and former students.

The members of the S. P. E. E. by assisting with the above inquiries will have much opportunity to contribute to the solution of the problem of selection.

May I also suggest that the "Problem of Selection in Engineering Education" be the topic of discussion for at least one meeting of the various Sections and Branches of the S. P. E. E. The "Careers of Engineering Graduates" should prove another useful topic for discussion by groups of those who are interested in engineering education.

Some are of the opinion that the needs of industry could be best served by having several steps in our engineering educational scheme. Suggestions have been made that the student of less than average ability could be prepared for the minor positions in one or two years of college training, that the average student should have three or four years and that those above the average should be given an opportunity for longer and more advanced study in order that they may be prepared for greatest usefulness. The fact that many engineering graduates enter the commercial field raises the question as to whether the regular four year curriculum should be greatly modified to best prepare such men for the less technical branches of industry. It is only by a careful study of the careers of our graduates and of the needs of industry that the above and many other important questions can be intelligently answered. The results of such studies when used in connection with a careful sorting of our students should place the engineering teaching profession upon a high plane of usefulness to society.

REPORT OF BOARD OF INVESTIGATION AND COORDINATION TO THE COUNCIL AT THE BOULDER MEETING, JUNE, 1924.

TO THE COUNCIL, S. P. E. E.:

The Board of Investigation and Coördination makes the following report for the past year. Following the correspondence with Dr. Pritchett of the Carnegie Corporation, which was presented in the report of the Secretary at the Ithaca meeting, a letter was received from Dr. F. P. Keppel, President of the Carnegie Corporation, as follows:

CARNEGIE CORPORATION
OF NEW YORK
522 FIFTH AVENUE
NEW YORK

October 31, 1923.

OFFICE OF THE PRESIDENT

Professor C. F Scott, Chairman,
Board of Investigation and Coördination,
Society for the Promotion of Engineering Education.

Dear Professor Scott: It gives me great pleasure to inform you that at the meeting of the Carnegie Corporation held yesterday the following resolution was adopted:

Resolved, That the sum of $108,000 be, and it hereby is, set aside for the purpose of making possible a study of engineering education under the direction of the Society for the Promotion of Engineering Education; that of this sum the following amounts be, and they hereby are, made available to the Society for the Promotion of Engineering Education:

$24,000 during the present fiscal year
12,000 during the fiscal year 1924

with the understanding that if, in the judgment of the Executive Committee, substantial progress shall have been made in his study by January 1, 1925, the balance of the $108,000 will be made available to the Society as follows:

$24,000 additional during the fiscal year 1924
48,000 during the fiscal year 1925

Sincerely yours,
F. P. KEPPEL.

On November 8 the grant was accepted on behalf of the Society and Mr. W. E. Wickenden was formally appointed by the Board as Director of Investigations. Mr. Wickenden began work on a part-time basis on November 15; he severed former connections and devoted his entire time to the Society beginning January 1, establishing headquarters in the Engineering Societies Building, 33 West Thirty-ninth Street, New York City.

Additional non-engineering members of the Board, as proposed in the correspondence with Dr. Pritchett last May, were appointed to serve during the period of the Carnegie grant as follows:

President Frank Aydelotte, Swarthmore College,
Dean Carl E. Seashore, University of Iowa.

Councilors from the National Engineering Societies, in accordance with the plan proposed at the Ithaca meeting, have been appointed by the Society as follows:

American Society of Civil Engineers: J. Waldo Smith and F. C. Shenehon.

American Institute of Electrical Engineers: F. B. Jewett and Gano Dunn.

American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America: William Kelly and Allen H. Rogers.

American Society of Mechanical Engineers: John Lyle Harrington and Frank A. Scott.

It will be noted that two mining societies have coöperated by the appointment of common councilors as suggested and arranged by President McNair.

A fuller statement of the history of the Board is contained in the reports of the Secretary in June, 1923 and 1924 and in the monthly issues of ENGINEERING EDUCATION.

The plans for the study as developed by the Director and sanctioned by the Board have been issued in ENGINEERING EDUCATION during the year and will be presented more fully

by the Director at the present Convention. Mr. Wickenden has secured the services of Professor H. P. Hammond as Associate Director on leave of absence until the fall of 1925.

The Board recommends the following action by the Council:

1. The adoption of the following resolution (incorporate here the resolution prepared by President McNair and addressed to the Carnegie Corporation).

2. That the Secretary of the Society be a member of the Board of Investigation and Coördination ex-officio (instead of being Secretary ex-officio as at present provided in accordance with recommendation III of the report of the Development Committee, which was approved by the Council).

3. That the provision in recommendation III of the Development Committee regarding the Director of Investigations which reads "and when appointed to be ex-officio Chairman of the Board," be cancelled.

4. That the vacancy on the Board, caused by the expiration of the term of M. E. Cooley July 1, be filled by his reappointment for a term of five years.

The members of the Board for the coming year, on the assumption that you will approve the appointment of Dean Cooley, are as follows:

C. F. Scott for one year,
F. W. McNair for two years,
D. C. Jackson for three years,
J. H. Dunlap for four years,
M. E. Cooley for five years,
The President of the Society ex-officio,
The Secretary of the Society ex-officio,
Frank Aydelotte during the period of the Carnegie grant,
C. E. Seashore during the period of the Carnegie grant.

Respectfully submitted,

CHARLES F. SCOTT, *Chairman.*

THE DEPARTMENT OF ENGLISH.

I still remember the thrill it gave me five years ago at the Boston meeting of the Society when I first heard somebody suggest that the full responsibility for the students' English could not be borne by the teachers of English in the engineering college alone. Coming as I had into this new field of work after years of teaching in a literary college, I had been somewhat depressed to find that most engineering educators expected that the whole cultural effect was somehow to be put into the engineering curriculum by introducing one or two courses in English into a schedule already overcrowded. By means of these magical courses, the department of English was expected to make the students throughout the college accurate in their speech, cultured and refined in their habits of thought, with a genuine taste for good reading, a wide knowledge of literature, and an interest in art and music and everything else that is fine. This was the burden of responsibility placed squarely upon our shoulders as teachers of a "cultural" subject. Is it any wonder I was weighed down in spirit? When Major-General Black at that Boston meeting suggested that the student could be made a cultured being only by having all of his subjects taught by men who had a background and a forward look, a sense of social responsibility, and a large sympathy for the students' point of view, it was a relief to feel that the burden was to be shared by others.

During the five years that have elapsed, I have rejoiced to see the willingness of the engineering faculties everywhere not only to broaden and liberalize their courses, and to humanize their teaching methods and individualize their contacts with their students, but to share with the teachers of English the responsibility of training the student to habits of accurate speech and accurate expression. The following let-

ter, which came to me in the course of recent correspondence of our committee with the engineering schools, may, therefore, state the case a bit harshly, but it is really too good not to share. And on the whole it has such a saving grace of humor about it that no one can surely take offense.

The complaint comes to the English department very frequently that the Engineering students do not know how to spell the commonest words correctly, even though they be seniors; and the query is made, "How did they manage to pass their English examinations?" My answer to the query is that they *did* spell the commonest words accurately when they were responsible to the English instructor for their English; but that when they had to spell the same words in a technical course—say, surveying—correct spelling ceased to be a science and incorrect spelling became an art! In other words, in engineering courses as such, both instructor and student, in spite of all their protestations in favor of efficient English, are prone to regard accuracy in English as relatively unimportant. If an instructor in an engineering subject should give a zero to any paper in which any four common words have been misspelled, he would be perfectly astonished—I say this with conviction—at the surprising accuracy of spelling in the subsequent papers handed in by his students, in nine cases out of ten. The tenth case would be one in which the student is either word-blind or tone-deaf, or both, and therefore incapable of making any improvement, so far as spelling is concerned, no matter how hard he tries. It does not do much good, in my opinion, to take off five or ten points from the value of a paper on "The Construction of a Power Plant' because of "bad spelling in general." The thing to do is to take off 50 points for misspelling such common words as *too, usually, auxiliary, definite,* and the like; and to give a flat zero to any paper which contains more than four misspelled common words after the student has been warned, and after he has been told to carry a dictionary with him and use it whenever these words are necessary in a written exercise. I would go so far as to allow a student the use of a dictionary in a written or oral examination, because in an examination he is under a greater nervous strain than he is ordinarily. If this procedure were carried through in engineering courses as well as in purely English courses, there would be a vast improvement in the English not only of the student but also of the instructor.

I must confess that the oral English used by some engineering instructors would never pass muster in a class in Freshman English, largely because the instructors do not care how their English sounds as long as they can "get the idea acrosst." I wonder whether the engineer—in-

structor or student—really appreciates the value of the spoken word, in contrast to the written word. How much of his misspelling is due to slovenly pronunciation? How much of his bad diction is due to the constant use of stereotyped, worn-out words and phrases which have about as much individuality and charm as a blown-out fuse? How much does he know about *why* we spell "foreign" as we do rather than "forrin," or "coming" rather than "comin," or "auxiliary" rather than "auxilary"? The writing and speaking of English is a science as well as an art; and if we talk about "efficiency" in mechanical engineering, let us—for goodness' sake—practise efficiency in English, both spoken and written. One of the best things any instructor could do would be to study the growth and development of the English language *as a science*. There are more things in English grammar and spelling than are dreamt of in his philosophy of "good English."

By all the laws of science, the engineering student and instructor should be models in the use of Engish grammar; they are taught that accuracy is the prime essential in scientific work. They know that "ain't" is ungrammatical; and "there's two motors out there," is inaccurate; and yet I will wager my last box of Prince Albert that both instructor and student will lay the blame for their use of poor English at the door of the English instructor who taught them in freshman year!

And this brings me back to my main point. As long as an engineering student is in an English class, he will usually write very respectable English, after he has received one or two zeros for misspelling four common words on any one paper. But as soon as he leaves a class where such drastic action is taken and enters a class in engineering where only five to ten points is deducted for "poor spelling in general," he will lapse into his old habits and the English department will receive a few more hints of their inefficiency in the teaching of English. Would an instructor in physics, after teaching a class for one year, expect that class to remember his teachings three years later if they had dropped the subject during the two intervening years? I do not believe so. Yet, heretofore, engineering instructors have expected their students, after one year's practice in English composition, either written or oral, to graduate wth a good knowledge of that subject in spite of the fact that these same *instructors* during the two succeeding years, have consistently violated the rules of good English in their class lectures and conferences.

I want to emphasize, therefore, the responsibility for the use of correct spoken and written English which is laid upon the shoulders of the instructor in engineering subjects. "If gold rusts, what will iron do?" said a master of the English language. If the instructor is careless in his use of spoken English, what can he expect from his students in regard to either spoken or written Engish? Very little, in all conscience.

Yet what emphasis is placed by the *instructor* in engineering upon these facts? Practically none. "I am teaching engineering, not English," he says. The probability is that he is teaching neither, so far as accuracy is concerned.

I venture to make this suggestion to both the engineering student and the engineering instructor. Practice reading aloud any interesting book—the Bible, "Babbitt" (that's good for something, but I am not sure what), "Bob, Son of Battle,"—any good book that is interesting, and listen to the sound of the words and sentences as thought-conveyors, just as an expert mechanic listens to the sound of a Studebaker motor (I "run" a Studebaker) to understand whether the car can carry its load easily and smoothly. One trouble with the engineering student is that, in respect to English, the eye has been trained at the expense of the ear. In my English class this morning I had an engineering student who could spell a word properly but he could not read it *aloud* to save his neck. He had never heard it pronounced and therefore he could not say it. Give me an engineering student or an engineering instructor who has a clear, clean-cut pronunciation and enunciation and I will take a long chance on his being able to spell, punctuate, and capitalize very respectably, whether he is writing on the deady fumes of carbon monoxide or the lively airs of "Carmen."

This brings me to the consideration of the relatively poverty-stricken vocabulary so frequently found among the college men, both instructors and students. The instructor talks for five hours of the days in the intellectual jargon of his particular profession, and his students listen to it and absorb it—usually in notebook form. The rest of his waking hours he spends in talking or in thinking in such general terms as "runs good," "a queer guy," "along this line," "seems like it ought," "a good stunt,"—and that is about all the vocabulary the worthy "red-blooded" man cares to use. "Get it acrosst; that's all you need," he believes.

I hope that any engineer who sees this letter will read it aloud; otherwise the writer will never "get it acrosst."

MINUTES OF THE MEETING OF INSTITUTIONAL DELEGATES, SATURDAY, JUNE 28, 1924.

BY DEAN O. J. FERGUSON,

University of Nebraska, Chairman.

Chairman: One of the things that should be announced at this time as of considerable importance to the institutional delegates is the fact that steps have been initiated this year, and especially at this convention, to have prepared and distributed a better statement of the meaning of Institutional Membership and the place of the Institutional Delegate. These have been fairly well understood within the official organization itself. However, it will be of decided advantage to have this more formal statement made and distributed during the year, especially to those institutions which now maintain institutional membership.

The primary object, of course, of institutional membership is to establish a more definite line of communication between the Society for the Promotion of Engineering Education and the institutions themselves, the official line of communication. That purpose is served by supplying to the institution the publications of the Society, and these publications are placed in the hands of the President, and also in the libraries. I shall not take the time to develop these objectives, but I will call your attention this morning to one or two things of that sort, because I want to emphasize what might be termed the major duty of the official delegate at this particular convention.

It has been my intention to try to impress upon the appointing authority by means of a circular letter which I sent out sometime ago, that we would like to have each official delegate make a definite report of this annual convention, or at least certain portions of the meetings, both to the president of the

institution and then to the faculty of the school. It is highly desirable that we emphasize our contacts with the presidents of our institutions. That can well be done by a brief written report as to the meaning of a convention like this one, with such detail as the delegate cares to put into it. The second report—that to the faculty of the engineering college—is the working report; it is the one which is most likely to be the notebook material that is taken back home. I should like, therefore, to ask definitely that each delegate organize for sometime in October a report to the faculty. He may handle it either as an individual matter, or if his institution is represented here by several men, he may call upon them to whatever extent he may wish. It might be considered a group or committee matter, if you are privileged to have the assistance of several of your colleagues here.

There are so many things in the present program that are capable of giving material for one whole session of the faculty at home, that I suspect the reports that will be made as a result of your official connection with the convention will vary remarkably in the ground covered. I can conceive of some of you as feeling that one particular phase of the subject matter that has been presented at this convention would be the most important item that you can report upon. You undoubtedly have been much impressed by certain parts of the program such as the discussion upon English, the length of the curriculum, the work of the section on engineering drawing. This morning's program bids fair to present something that will take certainly more than one session of the faculty for an adequate report, dealing, as it will, with the Freshmen of the engineering college. We have had some remarkable words of appreciation of the place of the engineer, by President Norlin. His characterization of the engineer as a humanist of the first order is not a matter for our self-congratulation. It is a comment for us to deeply appreciate, and to analyze as to the responsibility that goes with such characterization. President Walker's address last evening was outstanding in the number of things that could be brought forward for faculty

discussion. The work of the Board of Investigation and Coördination, of course, is one of the most remarkable things in the activities of the Society at this time.

I shall ask Professor Haultain, of Toronto University, to make a brief statement of his own method of handling reports upon conventions of this sort.

H. E. T. Haultain: Mr. Chairman, this is the first time that I am attempting to handle a report of a convention, and I can assure the Chairman there will be a good report, and not only one, but that there will be several. When the Chairman spoke to me yesterday, I said, "Why, certainly, our men have always presented reports, both written and verbal, and they have been of great benefit."

Chairman Ferguson: I asked Mr. Wickenden yesterday afternoon if he would make a few remarks this morning in regard to the place that an institutional delegate may have as a liaison officer between his institution and Mr. Wickenden's organization.

W. E. Wickenden: The institutional membership of this Society, as I take it, represents in the rudimentary form, at least, the organization of the engineering schools of the country collectively for any joint action to be required. This is a feature of the work of the Society which has received apparently relatively little emphasis. The Society had its origin with the individual memberships, and the institutional has not yet, to all appearances, found itself. We have gone very deeply into the history of the experiences of the organizations of other professional schools, and it seems apparent that the organization that is maintained by such a group as the Association of the American Medical Colleges, is serving the purposes of medical education in an outstanding fashion; in other words, its presentation to the administrative officers of the universities of a program which is a comprehensive one, and which has the backing of the whole group of the higher grade schools of medicine and of professional bodies as well, has been very striking and very outstanding in recent years. Further than that, this program of advancement has received

substantial mention, and the result has been very obvious. The Rockefeller Foundation has put $186,000 of money into medical education, calling for the matching of dollar for dollar—the money to be raised by the institutions. This is exceedingly important work, and one in which no other group of educators is disposed to take part. It is true that this has had a tendency to rather place a first mortgage on the funds which many institutions could obtain for the promotion for their program of medical education. They have a concerted program, and they have, necessarily, a program for putting the concerted program effectively before the attention of the administrative officers who suffer from the constant competition of different educational groups in their midst.

Now, having been listening pretty closely to the rumblings of the ground, I have not detected any indications of the desire to confer upon, or to transfer to, the Society any of the functions which now reside in the engineering school. The tradition of the engineering schools is one of outstanding independence. I think we want to take nothing whatever for granted about the degree in which the engineering schools as a group wish to develop the agencies of joint action and joint promotion, or even the formulation of an official program of progress, whatever that may be. I think we want to take nothing for granted, and yet I think we owe it to ourselves, with the development now had, to become more familiar with the plan of organization which prevails among the other groups of professional schools, and to try to form an estimate of their gains, as well as their sacrifices of individual authority and initiative which have come to pass as a result of these forms or groups of organization; and those things ought to be very carefully considered by the members of the Society who are charged with any responsibility of either the development of a new form of group activity, or for the modification of the basic prime organization of the Society as is set forth in the constitution; so that it seems to us that in the work of the Board of Investigation and Coördination,

the possibility of rendering service from the institutional side of this organization is rather promising, or, at least, it is obvious that we might be of some service to you by assembling and making available in a compact form the more salient features concerning the other groups of professional activity, and what evidences there are as to whether the steps taken have been effective. It seems to me we should emphasize the fact that this is essentially an enterprise of this Society, and that it may be possible to use the machinery of the local organization on the basis of institutional membership, or upon the basis of local branch society, as a connecting link between the Board of Investigation and Coördination, and the work of the individual school. To whatever extent that kind of connection can be used to emphasize the existence and the aims and the program of the Society, it would seem that it might be desirable to be used, as we think, as a point in the advancement of the organization, and to capitalize it in a somewhat conspicuous way. That, of course, must be a matter to be decided upon its merits at each individual institution; but so far as the staff and director and the Board are concerned, I take it that they are more sympathetic towards whatever emphasis can be given to the fact that this is an enterprise of the Society, and this local unit of the organization of the Society might very properly function as the official coöperative body.

Chairman Ferguson: The announcement for this meeting specifically brought forward a topic which we were expected to discuss very briefly—the subject of the student engineering societies. Admittedly, it is rather rash to open up a topic of that sort with only half an hour to put on the brakes. It is quite possible, though, that by having a few brief and concise statements as to the most productive forms of organization or of activity, we could have an exchange of ideas here that would be mutually helpful.

I learned since coming to the campus that, at the University of Colorado, at least one of the engineering groups is represented one hundred per cent. in student membership in a

branch society. That is a very remarkable thing. I am quite sure we will be glad to hear from Professor Hunter in regard to the situation.

J. A. Hunter: Last fall when I attended the annual meeting of the American Society of Mechanical Engineers in New York, I asked Mr. Hartford if any of the engineering classes had joined as junior members to the extent of one hundred per cent., and he said it was unheard of, and I made up my mind then that if it was at all possible I would try to put it over with my class this year. Now, I do not think I am to take any credit for that. I give credit to the president of the student branch. In the first place, we had the best man for the position of president; he was not the highest grade man; I think he took second honors, but his personality fitted him for leadership, and he was our president. During the year we kept a record of the attendance. The attendance of the Senior class averaged 88.5 per cent. The attendance of the Junior class averaged 80 per cent., a little better than 80 per cent.; that was throughout the year.

I talked with the junior president, early in the spring, and asked him if it would not be possible, and he said, "I don't think that anything is impossible with this bunch, with the interest that the boys are taking in the class this year." So he got to work, and on Commencement Day he handed me a package containing applications from every man that graduated in June, and promises from the two or three that will graduate on the first of September, that they would have their applications for junior membership in the Society. One thing that helped out, we had two or three live men from the Colorado section address the Society this spring, and they impressed the importance of the graduate taking out junior membership on graduation and affiliating themselves with the parent society. They impressed the boys with the benefits that they would derive, and they put it in a good strong way. Then, another thing, the parent society, as you know, has adopted a rule whereby a junior member will

have a year to pay his initiation fees of $10. You know how a man feels when he graduates, he doesn't have $10 in his pocket —not $10 to spare—but if he can pay that $10 any time during the year from his earnings, I think that will assist. I don't know whether the other national societies have that rule or not, but I think it is a good idea. I try to impress upon the faculty that it is their duty to attend every meeting and take part, and give a paper sometime during the year, or an address, and the coöperation between the faculty and the students this year was exceptionally good. That was kept rolling by the president of the student society, and we found that it was worth while to work a little politics. As you know, the members of the student society will probably elect the most popular man for their president the next year. Well, now, if you can pick the most popular man, and consult with him, you will probably get better material than you will if you leave it entirely in the hands of the students, and that was the way that we elected this man for the past year. He was an exceptionally good man, and he was a leader in all respects, and he was the one that put it across.

G. C. Anthony: I would like to ask Professor Hunter two or three questions, which perhaps will lead the general discussion here. I should like to know regarding this membership, how often the meetings are held, when the meetings are held, especially the times allowed in the program of the day?

Professor Hunter: We hold a meeting every two weeks on Wednesday night from seven until they are ready to adjourn. We started out with the idea several years ago of limiting the meeting to an hour, so that it would not interfere with the study period but you cannot get them to stay within an hour. It runs from nine to ten o'clock. At about one half of the meetings they have light refreshments—they have soda, ice cream, anything in season, oysters, and things of that kind, and that always brings out a crowd. The papers are limited to one paper a month from outside sources—that is, from the faculty or outside speakers—and the other paper or address,

or whatever it may be, by a student member. I found that the interest taken in the student papers was a great deal better than in the faculty papers, and some of our most delightful meetings were those conducted by the student speakers entirely. There were two or three in an evening, and they were better, I believe, for the faculty members than the paper from outside. We learn a whole lot from the experiences of the student members. Does that answer your question?

Dean Anthony: Yes. Mr. President, having been for twenty-five years in contact with societies although not actually engaged there to-day, I do have a very great deal of interest in this attendance business. I do not understand it now. I think there must be—

A Voice: There is John Hunter.

Dean Anthony: I think it is somewhat due to the fact that they have a father who looks after them.

A Voice: It is "Uncle John," not a father.

Dean Anthony: Now, we have given a long program once a month, and we do not get the attendance, I am ashamed to say. Classes are dismissed to go, and we have had some attractive programs, fair attendance, but nothing like it is here. I should like very much to know what the experiences of other delegates here are in connection with that.

Chairman Ferguson: In communication with the various chairmen of the committees on branch societies of the national societies, I have found that one form of organization that is growing in popularity, and in being more or less identically organized in various institutions, is an affiliation of branch societies. We have at Nebraska a typical case of that, it seems to me, in comparing it with the reports I have had from other institutions, and I have asked Professor Chatburn to briefly state what the type of organization is.

G. R. Chatburn: Yesterday someone made the statement in one of the meetings that the student societies had their life maintained by artificial respiration provided by the faculty. I want to say that such is not the case in Nebraska. The faculty has very little to do with the student organizations,

and I believe myself that the tendency of the past few years has been for faculties to encroach upon student activities too much. The faculties of the institutions are taking over such things as athletics, football, basketball, and things of that sort, which formerly were run by the students. It seems to me, as far as possible, the students themselves ought to run these institutions, and especially this end of it, and in that way they will take a great deal more interest than if the faculty uses a pulmotor to pull them through.

In our institution we have several of these branch societies. I presume I am called upon here because I was not favorably impressed with the branch society idea when it began. I rather felt that the institution was no place to work up sympathy for this larger foundation organization. But we have branch organizations of the American Society of Civil Engineers, of Mechanical Engineers, the American Institute of Electrical Engineers, and so forth. These different societies are independent; in fact, they have their own officers and hold a meeting once a month at a time that is especially provided for such meeting, and then these several societies are joined together in one general engineering society. This general engineering society holds one meeting a month on the same period that is allowed for the others, 11 o'clock, Thursday, is set aside for engineering society meetings, lectures, convocations, or something of the sort, so that we get one branch meeting, one general meeting, and two lectures each month. We do not always get the lectures, but we try to get them,—two each month,—from outside parties. The general society has charge of the publication of the *Blue Print*, which is the engineering publication that is run by the students entirely—student editors, student organization—and they have complete charge of the publication of these *Blue Prints*. The dues to this society are made to cover subscriptions to the *Blue Prints*, and both the general engineering society and the sectional society dues. Now, that has proven quite satisfactory, and we have not, as a faculty, interferred very much with the student work —not at all, except when they come to us for advice—and we

have had very good success. I believe that with privileges come responsibility; that if you give to the students certain privileges, allow them to think that this is their institution, they will take a great deal more interest in it than if you try to force something on to them. Each year when we have our engineers' week, we have an exhibit of engineering things about the university, which is attended by perhaps ten to twelve thousand people; the people wait for these exhibits and the students vie with each other in order to get up something that will be interesting, and we have a tremendously interesting week. This is all run by the engineering society, and each sectional society brings out its own particular part.

A Delegate: What part of the year is that week?

Professor Chatburn: In the spring of the year; about the third week in April or early in May.

A. M. Greene: About what time in the day do you have the exhibit?

Professor Chatburn: In the evening. The regular work goes on, except for one day. This is field day in which we have no classes, and the students go out and have any field day program they choose.

Dean Greene: What are your dues?

Professor Chatburn: They pay a dollar and a half, and we have succeeded in getting practically every engineering student in the University to pay dues. That covers the expense.

A Delegate: What time are the meetings held?

Professor Chatburn: Eleven o'clock is set apart. One of the most difficult things is working out a schedule. We have eleven o'clock one day each week left open. I am taking class on Saturday on account of it.

H. S. Evans: Professor Chatburn speaks about trying to force these things on the students, and not getting very good results by that method. I think that is correct, but on the other hand, I do not believe that you can get the best results unless you have at least very active faculty sympathy and assistance in these matters. I am sure that would be true in our case here. Professor Hunter in his most excellent report on

the affiliated branch of the American Society of Mechanical Engineers, did not tell the whole story, as we also had very active branches in the civil engineering and electrical engineering parts, and those have been uniformly very successful in this institution. I can recall without difficulty going to these meetings when the classrooms were crowded, a large classroom that will take care of the junior and senior classes very easily, and yet there would be not enough chairs to accommodate them; they would sit up on the radiators and stand on the desks, or anything they could find in the room—crowded to the doors. We often have that condition in these meetings, and I think it is because the faculty is sympathetic; but we have tried to get active students in actual control of these meetings, and they put it over by their spirit of enthusiasm. They go out and do personal work and get the men to come, and of course, they have a good time, and they urge them to come to the meetings, clear down to the Freshman class, even, where they have not been segregated into the different departments. They ask a man, "Are you going to take this branch of engineering? Well, then come to the meeting;" and if a man has decided, he will probably come. We have a general organization also, as Professor Chatburn has explained, called the Colorado Engineers, but it does not hold regular sessions of this sort, only business meetings. We have a required fee of one dollar per year, which is imposed by the Regents, and collected officially at the beginning of the year, and this fee covers the subscriptions to the *Colorado Engineer,* our engineering publication.

Anson Marston: Before we adjourn, I want to say on behalf of the American Society of Civil Engineers that we have an arrangement for the student members by which they can continue their student membership for a limited period after graduation by the payment of annual dues, which are very much smaller than the dues of the juniors. I think it is about five dollars, if I remember correctly—I do not have the exact figures in mind. Also, I would say that last year we sent out

a questionnaire. The committee, of which I happened to be chairman ever since it was started, sent out these questionnaires to all of the institutions at which we had student chapters, inquiring as to the situation in those particular schools, and the organization of their student branches. Almost without exception they repudiated this idea of Professor Brown's, that these chapters are maintained by artificial respiration by the faculty. We found the typical organization at an engineering school of considerable size—student branches of national societies, and then an engineering council composed of delegates from these separate branches, which act for the engineer division as a whole, and such activities as the engineers' week mentioned by Professor Chatburn.

R. W. Goddard: I was very much interested in the discussion of the Junior branch. It is a very active society with us. We have four branches of engineering societies, civil, mechanical, electrical and mining, and for the last three years our membership has been one hundred per cent. in all the lines of engineering. We have over 300 this year, and we have one hundred per cent. membership in the Engineering College. This is operated by the students; it is not a faculty thing at all. By getting the right man elected as president, as Professor Hunter has said, the work goes along very nicely, and it is very interesting to see. They go after those holding back and impress them into the Society. I am not sure that it has been four years, but I am quite positive that for three successive years we have had one hundred per cent, and we hope to go one hundred per cent. for the next year.

Dean Anthony: What hours are the meetings held, may I ask?

Dean Goddard: Wednesday evening, every two weeks, from seven to nine, if it is necessary to take that much time. At these meetings they try to have some eminent speaker. Our location there brings to the city a good many visitors, and in that way we are fortunate in getting before the Junior so-

cieties eminent speakers, and this is a big factor in arousing interest and maintaining interest in the Society.

Chairman Ferguson: This meeting will adjourn within five minutes. Is there other discussion from the floor?

G. C. Shaad: The beginning of these student branches came from the American Institute of Electrical Engineers, and Professor Scott. I would like to hear from Professor Scott before we close this discussion.

Chas. F. Scott: As I was about to become president of the Institute, I asked a good many people what the Institute ought to be, and called for suggestions for activity. I asked T. C. Martin, and he said, "I don't know what the electrical profession is going to be in the future, but in the past it has been doubling every five years. I thought then, in 1902, that you could conceive of electrical activity being twice as big in five years, and in ten years being four times as big. My conception has been that we all write papers and in that way build up knowledge of the art." That gave me a new conception of what we ought to do to build men, and I thought then that this machinery will have to be four times more active in ten years. I wrote a letter to a number of professors asking them whether there could not be some way in which the Institute might get in at college boys, and begin to have its influence on building up the electrical engineers of the future. I received two letters, one from Professor Jackson and one from Professor Ryan. Those letters are the things that started this. The idea was to get the students in the colleges in touch with the professional engineers, the national organizations, and get their influence behind us, and thus get the new students interested; and the drift of this conversation for the last hour has been that you get success when you do give that artificial respiration to the students to start life. If they get the right start, it is all right. The tendency toward leadership which is manifested by the students in their organizations gets into our own professional work. They know what they want to do, and we can show them how, and see that they get real

men, and then we will get the success for which we hope. I told them, the junior class, that their reputation was going to depend very largely on the type of officers they selected. I told them, "If you feel now you are going to have an unsuccessful year, get good leaders and you will have a splendid year." And the years differ very largely in accordance with the type of men who are selected as leaders. I think the growth of these branch organizations, some 250 of them now in the four societies, indicates the great importance of this thing. If it is now given the right direction of method, we are going to have one of the greatest movements in the building up of the engineering courses.

Chairman Ferguson: I regret that our time is so limited that we can not encroach upon the time of the general session further. In closing, I wish to make this request: After the faculty report is made next fall, say preferably during the month of October or the early fall session, at least, I should like to have a statement from the official delegates as to the nature of the meeting and the interest shown in it. If you will address that to me at the University at Nebraska, Lincoln, I will appreciate it. My address is O. J. Ferguson, University of Nebraska, Lincoln, Nebraska. Although we will all officially cease to exist as representatives and as institutional committeemen, I wish to make a summary report to my official successor.

RECOGNITION OF THE INDIVIDUAL*

BY C. E. SEASHORE

Dean of the Graduate College, State University of Iowa.

The discovery of the individual and the study of his traits and needs in modern psychology has brought forth a maxim in which I wish to couch my proposition for engineering to-day: "Keep each student busy at his highest natural level of achievement in order that he may be successful, happy and good." This maxim is so pithy and cogent that we can afford to read it and re-read it, accenting in turn each individual word, as each word of it stands for a principle and each word charges us with a responsibility. Thus, we may emphasize in reading, each, his highest, natural, achievement, successful, happy, and good.

An attempt to carry out that program will make it necessary to take into account: (1) the selection of the individual; (2) the placement of the individual at entrance; (3) the organization of individual groups; (4) the guidance of the individual; (5) the motivation of the individual; (6) the reward of the individual.

Mass production in education, and recognition of the individual, are two of the foremost problems in education to-day. They loom up large in contrast, because they seem to involve mutually contradictory problems. It is generally believed that mass methods stamp out the individual, or conversely, that recognition of the individual prevents the use of mass methods. But mass education is forced upon us, and the recognition of the individual with his personal traits, limitations, capacities and aspirations, is coming to be a persistent demand.

* Paper read at the meeting of the *Society for the Promotion of Engineering Education* at Boulder, Colorado, June 26, 1924.

Facing this situation, I am optimistic, believing that a *large* professional school is a good thing, and that it is possible to so radically change from the traditional small college methods of instruction to the methods demanded for mass education, that we shall be able to deal with students in very large numbers more effectively, more personally, and with more precise recognition of the individual than was ordinarily achieved in the small professional school.

The new day in society and the new day in education is marked by the fact that instead of a mere hit-and-miss growth, we are assuming conscious control of the evolution of educational tendencies, of the development of the individual, and of the shaping of the needs of society.

I. The Preliminary Selection of the Student: a College Qualifying Examination.

The great tragedy of all higher education to-day is the maladjustment, failure and misdirection of the student entering college on the towering and surging wave of "education for democracy." From five to fifty per cent. of freshmen fail and are eliminated in the first year. These students are sent back to home and community disgraced and disheartened, and constitute not only an economic waste, but a gross maladjustment of human energies, hopes and ambitions.

For this there is a simple remedy, and that is to develop a nationally standardized college qualifying examination which shall be given at the end of the senior year in all high schools and preparatory schools as a basis of information with reference to fitness for college work. On the basis of this examination, parent, pupil and teacher may make a rational estimate about the wisdom of going to college; and this examination, which is given merely for information, will be accompanied by expert analysis and advice in general principles of vocational guidance with reference to the outlook for persons of the various degrees of fitness for higher education.

Such an examination is being developed under a five year experiment now in progress. Two thousand high school students are examined annually. Prediction of probable success is made and this is correlated with the actual achievement of those who go to college, wherever they go. Thus we shall have a quantitative measure of the degree of precision of our power of prediction. The preliminary findings are exceedingly gratifying in this respect.

This examination will also serve to educate the community to the slogan "it makes a difference"; it makes a difference whether a student is or is not capable of doing college work. The examination will serve to encourage and select those not fully aware of their high qualifications, and to discourage and eliminate those who are not fitted, not only on the basis of this examination, but on common-sense observation in daily life, when the principle is once recognized and becomes a part of the neighborhood common sense. The student will make his decision about going to college on the basis of an inventory of his fitness for college, before he has burned the bridges behind him by actually going to the college, or even announced to his friends that he was not going.

Now, at this stage we cannot distinguish between the engineering and other professional or liberal arts students. It is enough to know that that student who is fitted to go to college is encouraged to do so, and that one who is not fit is discouraged on the basis of specific information about fitness for higher education.

II. Placing the Individual: Department Placement Examination.

When the student enters the Engineering School, he should be required to take a placement examination in each of the first-year subjects, such as English, chemistry, mathematics. This examination, administered by each of the departments independently, is designed to show: first, the degree of natural aptitude for the particular subject; and, second, the charac-

ter of preparation in that subject. It will be so prepared as to furnish the most effective introduction to the subject in the form of practical exercises for the first two or three days of the course. It will be of the objective type, and can be administered and scored easily, quickly and uniformly by cheap help so that, at the end of these exercises, the instructor will have in hand a rating for semester placement which shall be of as high predictive value as the experience of the entire first term in a heterogeneous group, provided the student is willing to work. The student will also have had a most effective introduction to the subject. These examinations will be prepared in small pamphlets and bought by the students like text-books at about ten or fifteen cents apiece. It is desirable that national standards should gradually be developed and furnished in fresh editions annually from the hand of the most expert writer in each of the respective fields.

The use of such a placement examination is essential if we shall start our student rightly at his natural level for achievement, taking into account natural aptitude and character of preparation in the subject as a basis for determining the pace at which he shall be set to work and the character of his task. The present practice of squeezing into the same form those who are by nature and by training radically different in their equipment and ability for doing the work of a given subject is indefensible.

III. The Natural Grouping of Individuals: Sectioning of Classes.

The most wholesome tendency in modern higher education is in the direction of individual instruction or, I should say, the privilege of individual work. In its organized form this takes the character of socialized group instruction, in which there is a natural give and take in the struggle for achievement, as in ordinary life, and the student is encouraged to pursue knowledge *actively* instead of having it poured into him as by our present methods. For this we are, however, not quite ready, except in the laboratory subjects, as it calls for

a radical reconstruction of our curriculum. As a temporary measure, our best procedure is to section classes on the basis of ability. After a careful study of all three methods in actual operation, I am convinced that any one of these three methods can be adopted effectively in fundamental courses without increasing the cost of education, and without the much dreaded conflicts between courses, while vastly improving the efficiency and naturalness of the educational process.

Sectioning on the basis of ability was in vogue in the best colleges of the country two generations ago, but was gradually dropped when elective courses were introduced, on the theory that it created conflicts. This theory of conflicts was exploded a few years ago by the discovery that if students in a given course in which there are two or more instructors, are registered by the hour instead of by the number of the section in parallel sections, interchange of students at a given hour can be made at any time during the semester by the two or more instructors in that hour, without the slightest interference with other departments or other courses in the same department. To illustrate, let us suppose that there is a class of one hundred students in freshman mathematics, and that fifty of them may schedule at 8:00 o'clock and the remaining fifty at 11:00. Then the two instructors in each of these hours may agree that one shall have the better half and the other the poorer half of the class reciting at that hour, and that promotion and demotion between the two sections may be made, and shall be made, on the basis of achievement at any time during the semester. Such sectioning establishes a fair basis for praise and blame, introduces fair standards of achievement, and creates a morale in the class. To the poor student it means kindness, comfort, justice and opportunity for relative efficiency and approbation. To the gifted student it is a means of finding himself and being motivated by effective competition; freedom from a dead load, stimulation of initiative, and the joy of achievement. This method is now the approved method in the best elementary and secondary

schools of the country, and all fundamental college courses are fast coming to that practice.

The method of sectioning combines well with lectures and demonstrations in large divisions, as the students at a given hour may meet in a large division for lectures. In laboratory work, it is however unnecessary, because here we can readily employ the method of the socialized group, allowing each student to work and progress at his natural level of successful achievement. The essential requirements are only that about three times the ordinary amount of work shall be mapped out; that the good students shall be so motivated as to distinguish themselves, both in quantity and quality of work; and that the highest twenty-five or thirty per cent. of the grades shall be given for work clearly above that represented by the highest grade ordinarily given in the unsectioned group.

Sectioning on the basis of ability, or individual freedom in the laboratory is, however, of no avail unless instructors adapt their methods and requirements to the radically different abilities now segregated. The procedure in each group, examinations, standards of achievement, sequence of courses for students at different levels, must all be adapted to the new situation. For each of the levels a different quantity of work is mapped out and a different quality of response must be required. At the lowest level there must be patient pedagogical drill on the fundamentals. At the highest level, the atmosphere of the scholar, with its freedom, large scope and enthusiasms will prevail.

IV. The Guidance of the Individual: Natural Finishing Places.

The societies here represented are primarily concerned with the standard engineering course which has a professional status, but in evaluating the setting of such a course, we must view it in relation to this fact, that the extension of the type of training represented by engineering should be varied in

proportion to, first, the needs of society, and, second, the capacity of students for training.

If this is true, other natural finishing levels than that set for the professional course should be provided, some longer and some shorter. Corresponding to the various departments of engineering, there should be junior engineering courses (not necessarily by that name), preferably of two years, of a combined trade and cultural character, leading to a certificate which would motivate our skilled tradesmen who are reasonably educated for democracy. The automobile mechanic, the head carpenter, the plumber, the road builder, and the hundreds of others who now face the alternative of four years or nothing, or a part of four years and disgrace, should in this school find the greatest opportunity that has ever yet been offered for the training of intelligent leadership among tradesmen.

I know there is a skeleton in the closet, but the situation must have an airing, for if we are going to extend higher education for democracy, it cannot be done by merely increasing the standard professional group. We must provide other outlets which shall enjoy the favor of occupational sanction. This is different from the ordinary trade school or manual training high school. It is trade and cultural education as a part of higher education. I would have these students take the so-called classical high school course and acquire scientific foundations for trade skill at the college level.

While such a trade school will probably be independent of the engineering school, the latter must function sympathetically in launching and sponsoring the former, and in the development of a good concept of education for skill in applied sciences beyond the high school level, particularly in promoting its certification.

Beyond the first degree in engineering, I would have various stages of specialized training in proportion to the needs for highly specialized experts and their capacity for training, even as far as five years of graduate work.

Now I submit that the lower the finishing place, the more men of that training we need, and the more qualify reasonably for it. In rough figures, we may say that for each engineer who takes five years post-graduate training, five should take three years and twenty-five should take one year. For every professional engineer of the standard course, we should have from two to five times that many educated tradefolk with a two-year certificate; for society needs a great many more men of the lower training than it does of the higher, and nature has provided a great many more for educability at the lower level than at the higher.

We as educators cannot visualize this profile of distribution without feeling great responsibility for an inventory of our concepts of natural units for education in applied science. We cannot guide the mass of youth who clamor for engineering education in the future without taking active steps to assist in the sorting or the progressive selection and elimination for different levels of training in applied sciences.

The recognition of this concept in the organization of training in applied science will have great value for the professional engineering course, in that it will furnish a means for progressive selection *for* and elimination *from* that course, thus securing a better grade of professional students and a motivation for those who are to do graduate work in engineering specialities.

V. Motivating the Individual: Spread of Assignment.

The procedures for motivating the individual are countless, and should be varied. They may vary with the character of the subject, the character of the instructor, the character of the institution; and it must always be kept in mind that different lines of capacity must be appealed to by different principles of motivation. Let me but mention one: the setting out of a task in which there shall be room for spread in achievement in proportion to the spread of capacity for achievement. To take a concrete example, entirely arbi-

trary: if the standard for achievement in freshman chemistry for the first year is represented by one hundred exercises of a certain degree of difficulty from the old point of view, this must be abandoned and work covering from two to three times that amount must be set out as a possible and desirable goal for achievement, with the expectation that a very small percentage of the class may achieve that goal, and that there will be a gradual distribution from this maximum achievement down to the point of failure. If it is announced that this three hundred unit basis represents the scope of the course and that grades will be awarded on the basis of achievement on *this* scale, taking into account the quantity and quality of work, then it will be found that more than twenty-five per cent. of the class when properly motivated will be distributed between the one hundred and the three hundred units of achievement: that is, above the level of the task ordinarily set for the class.

That this extraordinary enhancement of achievement actually does take place is illustrated in classes in which it has been tried, by the fact that (again using figures roughly) where a modern type of examination is given to all levels of the class, and is so arranged that the poorest students can only answer the first few questions, and that the best students will have the real test of their abilities in answering the last and most difficult questions, it will be found necessary to change the passing mark, say, from 70 per cent. to some empirical figure like 25 per cent., assuming that we know and wish to maintain the old standard of fitness for passing. That is, what under the old conditions used to represent 70 per cent. for a passing mark represents only 25 per cent. on the new scale. This is not lowering the standard of passing, but is raising the standard for achievement and basis for recognition of achievement on the part of the best students.

In my own classes in psychology, for example, all A's and B's (*i.e.*, about 25 per cent.) are given to students whose achievement is clearly beyond the standard of achievement

which was expected before the principle of segregation was introduced.

This first principle of motivation, then, of setting out a larger program, furnishing the material for the performance, making it known that grades will be based upon achievement, and that achievement will be measured at the level at which the work has been done, is a principle which can and should be applied in all subjects. In setting out such a program, it should be clearly understood among the students: that each will be kept busy at his highest natural level of successful achievement; that there are very great differences in the capacity for achievement; that each will be praised or blamed according as he achieves on the basis of his natural capacity; and, that we have frankly given up the idea of bringing them all to the same level. It is important that no student shall be permitted to feel that he is doing extra work when he is actually working at a high level of achievement.

The laboratory, of course, lends itself very freely to this type of procedure, and while there are various methods of laying out the program, it will probably be found in general that the best way is to arrange for each level a series of exercises or tasks, increasing in the order of difficulty so that the whole class is kept together on topics from day to day, and that the spread of achievement will be represented by quantity and quality of work on each topic. This is opposed to the idea, often prevalent, of setting out a mediocre standard and allowing the good students to pass rapidly from topic to topic, thus gaining time. There is no topic in any subject that does not lend itself to various degrees of intensive and effective work, and it is a better test of a good student that he shall have done a higher amount and a better quality of work on every topic, than that he shall have gained time by passing rapidly over a minimum requirement.

VI. The Reward of the Individual.

The greatest reward for a good student is the joy of achievement. If we once liberate the good student, give him facili-

ties and encouragement to work at his natural level of successful achievement, formal and outward marks of distinction will be of little consequence as compared with the deep satisfaction in doing this kind of work. To make this enjoyable, many institutions must, however, change their atmosphere so that both students and faculties will hail the superior student with approbation, instead of looking upon him as a "grade-getter" or a union-scale-breaker.

Nevertheless, the good student should be entitled to certain rewards. Aside from the privilege of being relieved from learning things that he already knows, doing things that he knows how to do, and marking time for the sake of the order of the class, certain natural rewards would be in place. Under the plan I have advocated, high grades will assume an entirely new meaning, and will in themselves constitute a much desired goal, a reward of honor which requires no special action of the faculty, because high grades under the conditions described will imply that the student has traveled in high sections, covered a much more extensive field, and done a far better quality of work than is now ordinarily required.

If honors are to be awarded by the faculty in a professional school, I think that they should be awarded on the basis of ranking of a number of students who have good grades, taking into account, first, the grade; second, the special marks of achievement deserving of recognition, particularly a scholarly attitude; third, balance of activities, representing health, socialization and academic life; and fourth, personality, in the sense in which personality is judged when an engineer is to be employed.

Taking this broader basis into account would protect the institution from making the egregious mistakes that are often made when honors are awarded on the basis of mere school record.

In the above, I have proceeded upon the assumption that students shall be held together during the customary period of four or five years in the regular order of topics, and shall all

take the same time. This, I think, would be entirely justified when, in the new order of things, the good student can have during these years the most excellent opportunities for natural growth and self-expression.

There is, however, another possibility which I should advocate if we cannot recognize motivation on the basis of ability, and that would be to adopt the method of individual instruction, which would enable the student to finish his course in a time somewhat proportionate to his capacity for work. There are many points in favor of this method, aside from the mere justice of it, and many of the difficulties which have seemed to stand in the way are mere bogies. However, if I had my choice, I should take the stand in favor of keeping the student in the engineering course to cover specific subjects in a fixed time, and then differentiate the quantity and quality of the work to be done in each topic.

I have spoken as an outsider, as boldly as briefly, on some of the most vital subjects touching engineering education, and have deliberately tried to set forth the ideas in high-lights and concrete form, in order that they may be tangible as a basis for discussion. Some of the things I advocate are already coming into general practice. All have been tried in some form. I have sought to find fault with existing conditions in a constructive spirit, and am glad to recognize that engineering draws as high a grade of students as any other profession, and is probably better taught. I bring no revolutionary theory or simple solution, but it seems to me from the point of view of applied psychology that the items I have mentioned are among the next vantage grounds that we might survey in engineering education.

PROBLEM COURSES.

By DONALD B. PRENTICE,

Professor of Mechanical Engineering, Lafayette College.

Much has been said and written of recent years in favor of the so-called "engineering problem" courses for freshmen. A course of this type was introduced at Lafayette College in 1918 and has remained a part of the curriculum for all engineering students. It is felt that the results are extremely satisfactory, although to a great extent intangible; which is to be expected as the aims are quite intangible.

Although the engineering curricula at Lafayette are identical for the first year, and definite choice of course by the student is deferred until May, yet an attempt is made at the beginning of the year to tentatively group the students according to their interests. Most of the men, at least ninety per cent., have already determined the branch of engineering they expect to study. Personal inclinations and the advice of parents, teachers, and friends are deciding factors and they have been operating before matriculation. This preliminary choice in no way handicaps a young man who later changes his mind. It brings together, however, immediately upon admission, kindred spirits and plants the seeds of professional pride. You may smile at the last phrase, but many college boys have greater pride in their professions-to-be than most graduate engineers who lament the general lack of it. It is partly to nourish this early pride that we believe in grouping, even though courses are identical.

Thus the heads of the various engineering departments meet sections made up almost entirely of their own future students for one period each week from the opening of the first semester. These boys have come to college with the idea that an engineering course will immediately initiate them into the mysteries of dynamos or steam turbines or bridges; and what,

with the exception of their "engineering problems," do they find? General science, chemistry or physics, mechanical drawing, and mathematics, with a sweetening of English literature and composition; in their minds nothing definitely connected with engineering, in fact much quite remote from it. But the engineering problem period is the liaison. Here engineering applications of even simple arithmetic are made and the student is given an introduction to the "engineering point of view." The intangible results are the most desirable and important. The stimulation of interest, the awakening of intellectual curiosity, and the development of an appreciation of the necessity for a solid scientific foundation for future engineering applications are not measurable objectively, but must inevitably improve the scholastic work, and the students' attitude toward this work, in the later years of their course.

In the mechanical engineering curriculum a second engineering problem course is introduced in the last half of the senior year. The object of this course is concisely stated in the college catalog. "The material usually covered in courses in heating, ventilating and refrigeration, automobile engineering, gas engineering, etc., is presented in the form of problems. Each student is considered a consulting engineer and assigned an individual problem the solution of which he later presents to the class."

Some of these problems are collected from various texts, while others are based on data from manufacturers' catalogs. The problem service for technical schools of the Westinghouse Company has supplied much ammunition for the course and these questions have led to many thought-arousing debates among the students and between them and their instructor. New problems are being suggested constantly, also, by conversations with other instructors, by journal articles, and by personal experiences. There is no difficulty in keeping the course alive.

No attempt is made to have each question illustrate one particular condition or theory. The aim is to present the problems in the ways in which they would be encountered in actual

engineering practice. Collectively they cover the whole range of mechanical engineering. They are rational, practical, fairly difficult in the theory involved, and require from one to six or eight hours each for solution. Every student receives mimeographed copies of all the problems so that the oral presentation of a solution can be intelligently followed by the entire class. This practice also allays any suspicions that the problems are materially unequal in difficulty. The scheduled time for the course is two three-hour periods per week making a total of ninety-six class hours during the semester. The students are not expected to spend any time on the course outside of class. One hour each week is devoted to the oral presentations of solutions. No textbook is specified, but the problems require reference to a handbook and to texts in heat, mechanics, and materials.

This problem course accomplishes many desirable results which I believe cannot be secured with equal breadth and effectiveness by any other scheme that has been suggested.

1. The course serves as a final review before graduation of all the science and elementary engineering, with definite practical applications.

2. It is generally accepted by engineering teachers that the specialized technical courses, which were formally included in the senior year, can not be retained in the present curriculum, but must give way to longer courses on the fundamentals and to non-technical electives. This problem course furnishes an opportunity to introduce many technical applications of engineering theory without taking a large percentage of the available time, nor requiring all the students to cover all the applications.

3. The course has all the advantages of the required thesis in stimulating a student's interest in individual problems and in addition offers him as a reward the privilege of presenting clever solutions to his classmates.

4. The importance of accuracy, orderly arrangement of calculations, and reasonable assumptions of theory or conditions, are impressed upon the students at a particularly appropriate

time, just before commencement of industrial work. A student is expected to defend his assumptions before the class.

5. The methods and advantages of the use of engineering books and articles as references are here taught by the case system.

6. The economic or financial point of view is introduced in many problems and choice of apparatus, based on ultimate costs under given conditions, is often required.

Nothing particularly original is claimed for an engineering problem course, as many schools have similar schemes. Few, however, offer such courses in the last semester before graduation, a location of unusual strategic value. Too many students acquire their engineering training in units and isolate the various subjects in mental compartments. A senior course in general problems affords a splendid opportunity to impress upon the near-graduate the fact that all subjects are related in engineering practice, that thermodynamics must call upon mechanics to produce a steam turbine, that freshman chemistry explains the operation of a gas-producer, and that violation of economic laws may commercially ruin the best engineering design.

THE ENGINEERING PROBLEMS COURSES AT THE UNIVERSITY OF WASHINGTON AND AT IOWA STATE COLLEGE.

BY FOREST C. DANA,

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There has been a great deal of discussion during recent years on the question of teaching methods in the engineering schools with particular reference to the use of the so-called "Problem" or "Case" method. The drift away from the lecture system seems to be largely the outgrowth of dissatisfaction with the results obtained in technical subjects using instructional methods patterned after those used in the non-technical colleges and universities. Writers in newspapers and technical magazines are constantly pleading for colleges to "teach men to think": to teach them to be originators, not mere copiers and followers. Various experiments have been made from time to time in the attempt to achieve these results. In view of these facts, members of the engineering profession may be interested in a report of work that has been done by two engineering schools in the effort to improve the effectiveness of engineering education.

Development work on a "Problem Course" based on practical problems has been carried on at the University of Washington for about nine years and at Iowa State College for about five years. The methods used in these courses have given such excellent results that it is felt that a definite advance in engineering education has been made.

About 1909 Professor C. C. More, of the University of Washington, began to put into effect some of the ideas and methods that were the outgrowth of his dissatisfaction with the results obtained with the textbook method of teaching Mechanics. He believed that there were ways to gain the

students' interest; better ways to induce them to attempt independent reasoning; some method whereby they could be stimulated to attack and solve a problem without being guided at each step in the solution. Many varied experiments were made; some failed to show any advance over the older methods, others gave decidedly better results, so were retained and improved as the flaws were found. New devices, suggested by instructors and students, have been tried out frequently. When these have been found to be effective they have been adopted as part of the general scheme.*

The new teaching methods used in the Mechanics classes proved so valuable in creating and maintaining interest, as well as giving the student an appreciation of the problems confronting the engineer, that in 1916 it was decided to try out an elective course for Freshmen in which the same methods and similar problems would be used. These experimental sections were successful and 1917-18 the course was made a regular part of the engineering curricula and was required of all Freshmen engineers. The name "Engineering Problems" was given to the course and has been retained for lack of a better one. The time allotted to this work is seven hours per week with three student credit hours, and covers two quarters only.

Since 1917 the subject matter of the course has been revised from time to time and the work as a whole has become better organized, but the basic aims and methods have been adhered to. The proper function of the Freshman course has become better understood by instructors, and class room methods, administrative details and instruction staff have been coördinated to work most effectively.

During the war Professor C. C. More and his assistant Professor Wm. E. Duckering, were stationed at Camp Humphries, Virginia, and conducted the work in the Department of Mechanics in the Engineering School. (See Mann Report and S. P. E. E., XXVII, 1919.)

* See S. P. E. E. BULLETIN, Vol. VII. No. 9, 1917, p. 518, for description of Mechanics course at the University of Washington.

Dean Anson Marston, of Iowa State College became interested in the work done in these courses and decided to introduce "Engineering Problems" at Ames, making it a required course for all except the Agricultural Engineers. Professor Wm. E. Duckering was put in charge of the work, and it has become a regular part of the training in the first year. Professor Duckering remained in charge of the work until he resigned in the summer of 1923. The writer then came from the University of Washington and took charge of the work in the fall of 1923. The work at Ames is conducted on much the same lines as that at the University of Washington except that the time allotted to this course is only three hours per week, but covers three quarters. This means that the problems have to be shortened considerably but the basic aims and methods are adhered to. In the fall of 1923 an elective course at Iowa State College in Engineering Problems for Sophomores was offered and development work on this is now being carried on. Like the first year's work this takes a single three hour period each week.

Aims of the Course.

The aims of the courses are varied and many of them are more concerned with the formation of the student's character than with mere problem solving. Among the things that the Engineering Problems instructors strive to do in their association with him, the following are prominent:

(*a*) To aid the student in developing initiative, to encourage him to think for himself. Aid him in acquiring the habit of forming judgments.

(*b*) To awaken in him a willingness and desire to grapple with a new and difficult problem.

(*c*) To coach him in direct and systematic methods of thinking.

(*d*) To train him to record his work in clear and systematic form so that the results of his efforts will be intelligible and valuable to himself and others.

(*e*) To establish a foundation for the student's acquaintance with the few fundamental principles that underlie all engineering work so he can recognize these fundamentals in a problem and then apply the proper laws necessary to obtain a solution.

(*f*) To encourage the development of the engineering attitude toward obstacles, unfamiliar situations and unpleasant facts.

The men who have developed the Problems courses also believe that among the many thing that should be done in a course of this type, one of the important things is to help the entering student find himself. The work should show him something of the type of problems the technical man must solve; something of what is meant by the term "Engineering," so the student can decide early in his college career whether or not he really wishes to prepare himself to follow some branch of engineering. A few students find that they have no aptitude for mathematical or scientific computations and are thus enabled to direct their efforts to more congenial lines.

Most of the instructors' thought, however, is devoted to devising means of giving the student a definite, *emphatic* start toward the formation of good habits in studying and in working. They try to develop the *individual* student, preparing him for the technical work that follows.

It is evident from the foregoing that the student must do his part if he is to profit in any large measure from the course. He can not be a mere listener. The instructor having the aims of the course clearly in mind, naturally becomes a coach and guide as well as a teacher. The instructor has two duties; first, to EDUCATE his pupils; second, to TEACH them. The distinction between these two duties, as seen by the men who have been developing the "Problems" work, is well brought out in the definitions of the words as given in the Standard Dictionary.

"To EDUCATE is to *draw out* or develop harmoniously the

mental powers and in the fullest sense, the moral powers as well."

"To TEACH is simply to *communicate knowledge.*"

In the engineering problems courses they try first of all, to develop the student, to train him in good *habits* of work and study: the communication of information is secondary. It is obviously true, as stated by various writers, that a man can not *think* without a store of facts to draw upon. This truth is recognized and a student is not expected to produce results without "tools." Enough facts are given the student in the statement of the problem or in class discussion to enable him to make a good start on the solution. Others are given from time to time as the NEED for them is discovered by the student. The memorizing of many facts is naturally essential to the efficient handling of any problem, but this memorizing is best obtained through the constant USE of these facts as *needed tools.* Under these conditions the student will remember much that is merely informational in its nature because it has an immediate bearing on the problem at hand. Unmotivated memorizing and memorizing by rote is never required. He is not compelled to derive or prove a lot of formulas before he is given a concrete problem. On the contrary, he starts work on a practical problem the first week and the writing of definitions and statements of laws becomes incidental to its solution. Introduced in this manner, these proofs and laws are accepted as a matter of course. The use of formula as formula only is not tolerated. The student is expected to use the laws in the fundamental word statement form instead of the derived, symbolic formulas he may use later in practice where he has many problems of the same type to solve. In this work he is *studying fundamentals;* not trying to solve vast numbers of problems. One problem thoroughly understood is far better than a dozen solved mechanically.

ENGINEERING PROBLEMS COURSES.

Organization of the Class.

As has been previously stated, the instructors in Engineering Problems are trying to develop the individual student. They want him to learn to rely upon his own unaided efforts in solving a problem or overcoming a difficulty. They want him to develop his initiative and independence. For this reason class room conditions are made as favorable for individual effort as possible. Earnest students like to do their own work undisturbed and appreciate regulations that protect them from the thoughtless or lazy student who asks his neighbor for help as soon as a difficulty is encountered. For these reasons individual work is insisted upon. Students are not allowed to confer with their neighbors at any time or to move about the room. Desks are usually assigned and each student is expected to remain at his place unless given permission to leave it. To encourage a sense of responsibility each student is held responsible for all that goes on during his absence from the class room. Before returning to class after being absent one or more sessions he is expected to find out what was done during his absence and prepare himself to carry on the work with the rest of the class.

Subject Matter of the Courses.

Much thought has been given to the subject matter of the courses and the arrangment of the various topics in each course. Experience has shown that problems dealing with motion are usually the easiest for the beginning student to grasp and so the first quarter's work at both Ames and the University of Washington consists of simple problems in dynamics. The fundamental ideas of "Work," "Energy," "Power," "Inertia," and motion are introduced in a series of problems dealing with pumps, hoists, trains and other moving objects.

Problems dealing with the laws of equilibrium are taken up in the second quarter at Washington and in the third quarter at Iowa State College. The laws of equilibrium are

introduced by means of practical problems dealing with simple derricks, towers, trusses and beams. At Washington several weeks are spent on the graphic solution of stresses and reactions of simple trusses as a check method on the previous work. Interest is high and the work is of good quality.

The subject matter in the second quarter at Ames was changed about two years ago and now takes the place of one hour of mathematics. The work is closely coördinated with the trigonometry course and all of the problems are taken from this field. So far as practicable, the methods used in the other courses are adhered to in this work.

Slide rule instruction is given in the first quarter at Washington and in the third quarter at Ames.

The elective course given in the second year at Ames will be a continuation of the first year's work except that the subject matter will be the engineering applications of some fundamentals of hydrostatics, flexure, rate curves and calculus. In general the problems will coördinate with physics and calculus.

Methods of Teaching Used.

To be most effective, learning should be accompanied by interest. The student's interest is gained by bringing him practical engineering problems where the utility of the desired solution is apparent long before the underlying laws are seen. By discussion and illustrations based on simple, common things, the fundamental principles of "Work," "Power," "Equilibrium" or motion are put into clear, definite statements which may or may not be later put into scientific terminology. The application of these laws to a problem does not have to be taken for granted by the students, as the laws are developed by means of a concrete problem.

The problems which are the vehicles for these basic ideas are known as "Study" or "Introductory" problems. The settings are forms which experience has shown to be the most satisfactory for the purpose. They are often quite broad in their scope so that the principles may be introduced in

their general form rather than in a narrow, limited application. There is but little more time required or difficulty experienced in presenting the topics in this way than in presenting the " special case " first. The student is usually equally ignorant of both cases. As Stratton says,* " General truths, when seen and understood, are so much more powerful instruments than are mere particular and detached bits of knowledge, that surrender upon this point will hardly be permitted by any able teacher."

Experience extending over many years has shown that this method of introducing the fundamentals in the general form is a very efficient manner of teaching, as it economizes time for both student and instructor. At the end the student has a broader grasp of the subject and can apply his knowledge to a wider range of problems.

The solution of the study problem is guided by frequent discussion and the correct method of attack is clearly outlined. The application of the fundamental laws is emphasized and the student is encouraged to ask questions when any point is not clear.

Following closely after the study problem a series of " Drill Problems " is given to train the student in the application of the laws to many different situations. The student is here thrown on his own resources and is encouraged to discover for himself the proper method of getting a result. He is told to make estimates, to analyze the problem and to make a definite plan of attack. Aid is given only when the individual is hopelessly " tied up " or when the majority in the class are in trouble, indicating that some basic point is not understood. Only enough help is given to get the student started again. Drill problems are chosen from a wide field, some are very simple, others are more complex. In general, it is the plan to give problems that can be completely solved by the average student in the time available in any given class period.

The fact that a general form of problem is used to INTRO-

* Educational Monographs—"Developing Mental Power," Stratton, p. 25.

DUCE the fundamentals does not mean that the student is thrown into untold complexities in his first drill problem. Moderation is as essential here as in other things. Once the project problem is well under way and some of the fundamentals have been uncovered, the student is set to work on a drill problem that will call for the application of one or more of the laws brought out in the previous discussion. The drill problems are more or less simplified or " special case " problems and may use but one or two of the principles previously brought out. As far as practicable the drill problems are "real" engineering problems, that is, the data are taken from some actual structure (or mechanism), or is at least possible. Of course this drill problem may be only a small part of the complete undertaking. Care is taken to change the arithmetic and settings of problems frequently in order to discourage the student's tendency to rely upon mechanical memory instead of his reasoning powers. He can not blindly follow the path blazed in yesterday's work and get a correct result in today's problem. He must analyze the problem, determining the laws that apply and the order in which they must be considered in order to get the solution.

Since the slide rule is one of the engineer's most valuable tools, it is important that the student be thoroughly trained in its use. In order to have the principles of the rule clearly understood by the student it is introduced in its fundamental form instead of merely demonstrating the making of various " settings."

The student plots a series of logarithms from the logarithm of 1 to the logarithm of 10 and thus constructs a " graphic logarithm table." He performs various calculations with algebraic logs and immediately checks his answers by using his " graphic log table." He is led to discover for himself the fact that the decimal point can be just as accurately determined when using graphic logs as when using algebraic logs. After he has solved a number of problems with his paper rule he takes up the use of the regular slide rule and

finds that it is the same graphic log table but put in more durable and convenient form. This preliminary work takes the "mystery" out of the rule and the student loses his fear of it. Many sets of drill problems have been prepared and the student is given frequent practice in reading the scales and in the determination of the decimal point. The use of approximate solutions or "rough computations" to determine decimal points is not tolerated on the score of being inefficient and tending to breed lack of confidence in results. Particular emphasis is laid upon the fact that the slide rule is merely a graphic logarithm table and hence the decimal points can be just as accurately determined when using the slide rule as when using any other log table.

While the study problems are effective in motivating the course, it has been shown that the solving of the drill problems gives the truest measure of the initiative, perseverance, ingenuity and attitude of the student in addition to an indication of his ability to accurately solve a mathematical statement. The drill problem is also the channel by which training good craftsmanship is given. The correct answer to the problem while essential, is not the only goal in view. Method used, orderly attack, clear and systematic record of every step in the solution are all considered when grading papers. Emphasis is laid upon the necessity of the engineer's putting his work up in such shape that no one can doubt his meaning. This calls for drill in the drawing of clear sketches, instruction in the proper arrangement and indexing of computations, insistence on the use of neat, legible, well formed letters and figures and correction of the improper use of English. Many engineering office methods and standards are used whenever they will fit into class room routine. This care in the manner in which the work is recorded has a twofold purpose. First, it gives the student an early start toward the formation of habits of neatness, accuracy and system in the work he produces. Second, this thought about the manner in which operations are recorded tends to make the student less hasty in his mathematical processes and as a result he finds himself giving

more thought to the inward meaning of the problem itself. Speed comes later, it has no proper place in the study of fundamentals. Kitson * says, " Education is a process of forming habits in the brain." Also, " Guard the pathways to the brain . . . with respect to *what* enters . . . and with respect to the *way* things enter." . . . " As you value your intellectual salvation, then, go slowly in making the first impression and be sure it is right." This is the guiding principle in all of the work in engineering problems, *making first impressions right.*

Results.

In talking of the results obtained one can speak in the most general terms only. It is futile for anyone to claim that a student's success is due to some particular course or even any series of courses. Success is too hard to define and the factors leading to it are so many and involved that no man can say definitely which contributed most to his advancement in life. There are some things, however, that can be definitely ascribed to the training in Engineering Problems. One of the first things noted by the instructors is the accurate measure obtained of those students having the wrong attitude toward their studies. The instructors in this work always hesitate to say that any student is hopeless but they find that they can usually tell when a man is misplaced or is handicapped by reason of poor attitude. Many students totally unfitted for the technical side of engineering have been guided into more congenial lines of effort. At the time these men are being discovered, men of superior ability and character are also found and they can be helped to direct their energies to the best advantage.

The effect on other courses. At the University of Washington where Engineering Problems is a three credit course a very decided improvement in the work done in several subjects has been noted. Since the majority of the problems have been taken from the field of mechanics, it is natural that the

* Harry D. Kitson, "How to Use Your Mind."

greatest influence on subject matter is seen in the Mechanics work. Mechanics students at Washington are doing work of much better quality in every way, more difficult subject matter is successfully handled and it is put up in much better form than was done ten or twelve years ago. One of the most pleasing things noted, however, is the spirit in which new and difficult problems are approached. The morale of classes is very good and the men attempt the most difficult and involved problems without a murmur, sticking at the work like veterans.

As soon as students in Hydraulics found that they were expected to do work of the same workmanlike quality that they did in Mechanics and Engineering Problems the improvement in the reports turned in was startling. Moreover, these men again show the improved attitude, working persistently in spite of the fact that they have all the difficulties usually experienced by students in this subject.

The effectiveness of the slide rule instruction method has been apparent in several courses but one unexpected result has been noted. The instructors in surveying at Washington stated that they observed a decided improvement in the facility with which the students used logarithms soon after the slide rule was introduced in the Freshman year. Surveying regularly comes in the third quarter, and the Freshman now has six months drill on the rule before he takes up this subject. In addition to his increased proficiency in the use of logarithms and the slide rule, the surveying instructors have noted the improved quality of the computation sheets in regard to clearness and neatness.

On account of the shorter time allotted to the Problems work at Ames it is unlikely that any very pronounced effect on the grasping of the subject matter in later courses will be noted. For this reason the emphasis is placed on the use of systematic methods of attack, drill in fundamental mathematics and practice in making clear and orderly computations. It is the consensus of opinion at Ames that there has been a very great improvement in the manner in which students put

their work on paper. Several instructors have stated that the course was well worth while even though no other effect was discernible. There has been considerable improvement in the facility with which students in later courses handle problems involving the use of trigonometry. The intensive drill in the use of logarithms and the trigonometric functions seems to have a very beneficial influence on their ability to use this branch of mathematics.

For several years effort has been made at the University of Washington to determine the attitude of the students toward the work and methods used in these courses. The great majority have expressed themselves in favor of the training in clearness and system and practically every one seems to favor the requiring of individual work and the maintenance of strict order in the class room. Students frequently volunteer the statement that they "like to work where the discipline is strict, where every man sits at his own desk and does his own work."

The course is in the process of evolution and will continue to change somewhat year by year as the instructors discover better ways of doing their work and the most effective arrangement of the material in the courses. But considering the results obtained thus far, it is believed that a forward move has been made in the educational methods for engineers and this progress report is offered to the profession for discussion and suggestions.

EDUCATION IN ENGLISH FOR ENGINEERING STUDENTS.

BY BRADLEY AND MERWIN ROE STOUGHTON,
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The writers believe that this subject has not had the free discussion which it deserves, and especially that it has not been sufficiently discussed in a constructive way between the three classes whose opinions are most valuable, namely: the Department of English, the graduate practising engineer, and the engineering faculty. Suspicion of the engineering faculty lurks in the minds of instructors in English, and, on the other hand, the engineering faculty, alarmed at the small amount of time available for professional subjects in the usual college course, almost begrudges some of the time given to instruction in English, although freely admitting that such instruction is important to the student and to the community he is to serve. At the 1923 Convention of the Society (see *Proceedings*, Vol. XXXI, pages 248–252), Miss Harbarger struck the keynote of much of the comment of the English instructors when she urged the teachers of English "not to lose their ideals by trying to keep in step with what they think the engineering faculty wants"; while the engineering faculty gave a demonstration of their attitude by saying very little, or else remaining away from the symposium altogether.

Instruction in English for engineering students has two chief objects: The first is to serve as a medium of culture, in order to enrich the student's future life. During the symposium to which I have referred, Professor Pearson, of the Massachusetts Institute of Technology, said that his department had eight hours a week for two full years in which to give the students in engineering their training in composition and their cultural background; later the students have elec-

tives in public speaking, literature, fine arts, and musical appreciation, and are required to work on report writing, etc. Professor Thompson of the scientific department of Yale University, said the engineering students had a uniform freshman year with the academic students, followed by one term during which they were trained in collection of facts, recognition of their relative importance, and their logical relationship; and a second term aiming to stimulate the student's imagination and to develop his appreciation of literature. Under the right men, these opportunities are sufficient to lay the foundation of culture and also inspire a thirst for culture in any group of intelligent students. In less time than this, Professor William Lyon Phelps has inspired in hundreds—perhaps thousands—of young men an appreciation of culture and a life-long affection for good books. But, unfortunately, for every instructor capable of inspiring his students, there are a great many engaged in merely "exposing" them to knowledge, or transmitting information without inspiration. Precisely the difference between "teaching English" and "Education in English" is what we mean by this.

The second object of instruction in English is to give to engineering students the ability to convey exact information in the spoken or written word. This object is so different from the one discussed previously, that it is questionable indeed whether the same instructor is fitted to accomplish both of them. Certainly the two objects are sadly confused by many Departments of English in engineering schools and it would be interesting to know what proportion of instructors in English are themselves in the habit of communicating merely the essential facts in terse, concise, and exact language, or capable of training others to do so. This form of English expression, whose merits are brevity and exactitude, is very different from "created" compositions, based on an incident or observation, like the work sometimes demanded of engineering students. To illustrate this difference, compare a good engineering report with Richard Harding Davis', "Soldiers of Fortune," which is based on an engineer and

his work. Each is a sample of "English," yet the two differ from one another as much as the North Pole from the Equator; one is cold, dry, meaning just what it says, incapable of suggesting anything more; the other is thrilling, stimulating, inspiring to the imagination. Both have made their contribution to humanity; one as fact, the other as fiction. The intellect trained to produce one type of English must unlearn its mental habits before it can excell in the other form. Therefore, a Department of English which aims to "stimulate the students' imagination," or train them in "English composition," is tending to unfit their minds for direct, scientific thinking.

Before an engineer is able to write a good report, or a patent specification, or a monograph for publication by his technical society, he must be capable of strict adherence to the least number of essential facts, attractively presented in the fewest possible words, which admit of only one interpretation. The story is told of a student who was asked to write a composition on the persecution of the Christians in the first century; he wrote: "The Persecution of the Christians in the First Century. It was something fierce!" That master of the short story, Guy de Maupassant, has given us a description of the great Creusot steel works. It is thrilling, fascinating, inspiring! It is fanciful, incorrect, misleading, yet it should be read by every engineer for the sake of the quickening of the pulse which comes from the poetry and romance woven into this sordid, unsightly, utilitarian object by the genius of literary imagination. An engineering student who could write a theme like that on any engineering subject, should be persuaded to abandon his chosen career, on the ground that his mission in life is greater than mere engineering. Pennell has produced a marvellous series of etchings of iron and steel works, which tremendously stimulate the imagination and make them seem to be things of beauty. But those of us who hope to have good factories built from our designs had better stick to ugly blue prints, with plain lettering, ruled lines for

railroad tracks, and scores of unimaginative figures and arrows.

Do we mean to indicate by these illustrations that stimulating the literary imagination and exercise in composition is unwise training for prospective engineers? We do—for two reasons: If these capabilities could be acquired by a student without the expenditure of precious time, they might increase his resource and culture, but they require more time to achieve, and are much less apt to be achieved by the average student, than the culture which comes from appreciation of literature, or of beauty in any form. Creative imagination is not essential to culture, and anyone who habitually reads good literature and understands the principles of clear, terse literary form is capable of expressing himself adequately when occasion demands. The time spent in stimulating literary imagination would be far more valuable to the student if given to cultivating appreciation of literature, or of teaching how to marshall facts and figures which do *not* come from the imagination, and putting them into the most intelligible and presentable form. The average student shrinks from theme writing, because he instinctively realizes that 95 per cent. of the time which should be spent in learning the fundamental principles of *how* to write clearly and concisely is exhausted in cudgelling one's brains and straining one's imagination to think up *what* to write about a given subject. For a literary man it is necessary to think up what to write and how to write, but an engineer must never call on his imagination to tell him what to write; all of that must be before him in the form of data or figures before he starts to express it. The literary appreciation, and, therefore, the culture of an engineering student may be hindered, not developed, by attempts to stimulate a creative imagination which he does not possess and does not want to acquire.

Another objection, besides that of inefficient use of valuable time, which we urge against stimulating literary imagination in engineering students is that the thought of to-day may become the habit of to-morrow. The habit of creative literary

imagination is a detriment to an engineer; therefore it is a dangerous attitude of mind to assume on occasion. Every percept which has attention from an intelligent man becomes a concept, and the kind of concept it becomes depends on the mind of the thinker. Let us illustrate this by a semi-humorous example: Milton took the subjects of a fall and an apple; with his extraordinary literary imagination be created one of the outstanding classics of the language, beginning:

> "Of Man's first disobedience, and the fruit of that forbidden tree
> Whose mortal taste brought death into the world,
> And all our woe. . . . "

Precisely the same ideas, working in the mind of Sir Isaac Newton, resulted in his pronouncement of the law of gravity. Again: Literary men for centuries have been inspired to flights of poetic imagination by the kettle on the hearth, which humble instrument was the direct means of James Watts' invention of the steam engine. The two different types of mind each produced a wholly different result from the same starting point. Now it does not follow that one individual might not possess both types of mind, but it is a matter of record that few, if any, such individuals have been known. Therefore, we say that a creative literary imagination is a detriment to an engineer, because it distracts his mind from the direct, unfanciful correlation of observed data which constitute creative engineering imagination, and which have been the chief means of bringing mankind nearer to a knowledge of truth concerning the physical world, and of constructing great works, great processes, and great industries. Kipling had to learn something of ship building and bridge building before he could write "The Day's Work," but it would not have improved that book if he had undergone a course of stimulation of engineering imagination in advance by being forced to build a ship. He could watch the building of it; yes. Just as our engineering students can get their acquaintance with English by reading good literature, but not imaginatively creating it. Likewise Newton and Watt probably found it as uncongenial a

task as does the modern school boy not interested in literary creation if they were forced to write themes, or compositions, on the fall of an apple, or the boiling of water. They doubtless would have lost an enormous amount of time trying to think what to write on the subject in order to meet the wishes of the English instructor, instead of recording the facts in the briefest possible manner and then searching for the fundamental truths underlying them.

We do not want the preceding paragraph to be misinterpreted as an argument favoring ultra-specialization; nor as opposing the possession by engineers of a pleasing literary style. We do not urge that future Newtons and Watts should be encouraged to spend 100 per cent. of their time in creative scientific activity; nor that Milton and Kipling should have devoted all their time to creative literary activity. But we do believe that each type of mind better serves mankind if it is relieved of *creative* activity of the alternate kind. We know that instructors in English will argue that they meet the situation as best they can by telling the engineering students to write on some subject which "comes easy" to them, like an engineering project, or a visit to a neighbouring plant, or even a football game; that they do not aim to produce a Pope or a Kipling, but only to give the students some facility of literary expression. Nevertheless too many theme-writing students, with stimulated imaginations, habitually avoid a brief, direct statement in an examination paper or technical monograph, and resort to "padding," as if they hoped to be "heard for their much speaking."

How then can an engineering student be taught to present data in a concise and attractive form without stimulating his literary imagination? Obviously, by giving him all his data and teaching him the principles of preparing it for both verbal and written presentation. Most engineering colleges now have a uniform freshman year, during which the student is taught general subjects and aided in choosing the appropriate speciality which he will study for the following three years. If a student is considering becoming a civil engineer, he can

be given for study short biographies of eminent civil engineers. The leading engineering societies publish biographies of recently-deceased members of prominence, and usually have several copies for distribution at cost. Then, after a student has learned the principles of preparing data for presentation, he can learn to apply these principles by preparing the salient features of a biography for presentation to his classmates. In this way he gets the training he needs, and, at the same time, learns something of the life activity and characteristics of men of his prospective calling before he must make his final decision. From his classmates' presentations he learns of other types of engineers and engineering. In his sophomore year he is far enough advanced in his engineering work to treat in the same way recent monographs on elementary engineering subjects. The more recent the monograph, the more stimulating it is to his interest and the more eagerly he prepares it for presentation to his fellows. The large libraries—and especially the Engineering Societies' Library in New York City—are always able to select wisely and furnish at moderate cost the most recent monographs of a character as elementary as may be specified and likely to be interesting and popular. On this particular feature (among others) depends, of course, the success of the plan. The other features essential for success are quite within the control of the Department of English.

Summary.

Students in engineering require more training in English than most of them are getting at present, for two distinct, unrelated, and almost opposite objects, namely: The first to enrich their lives and characters by increasing their resource and culture; the second, for the wholly utilitarian object of enabling them to use English as a vehicle for expression, and for "selling" themselves and their ideas.

As seen from the engineer's viewpoint, many Departments of English fail to interest the students of engineering in this cultural training, and sadly confuse these two different ob-

jects. Too often they seem to be ignorant of the kind of vehicle needed by engineers. It is recommended that instructors in English initiate a discussion of these important questions, by mail or otherwise, with graduates of their institutions who are practising engineering.

In the body of this article we attempt to show that creative literary activity, such as theme writing and composition writing, is not desirable training for engineering students, and does not help them to present engineering data in brief and attractive form which can be easily comprehended and is not tiresome or misleading.

We also have tried to show that the Engineering Societies and large engineering libraries have facilities which are doubtless at the service of Departments of English in colleges, to provide material for a better type of training.

REPORT OF THE SECRETARY FOR 1923-24.

The present year has been in some respects the most noteworthy in the history of the Society. The Carnegie grant with the consequent organization of the work of your Board of Investigation and Coördination is a matter of the first importance to the Society.

The Board of Investigation and Coördination.

This was a just recognition of the faithful service of the Society in the promotion of Engineering Education. However, such a recognition brings with it grave responsibilities. This is the first time, I am told, that a grant has been made to a group to study and investigate its own problems.

If this study is successful and accomplishes results worthy of the Society, other such studies will, I understand, be undertaken. In other words "it is up to the members of this Society to make good."

A detailed history of the movement to secure these funds was presented in the last report of the Secrtary, but it is of such importance that I give below a brief summary leading to this grant:

1. The election of Professor Charles F. Scott as President at the Yale meeting, and his reelection at the Illinois meeting to serve a second year, the first time a president has served the Society for two years. His enthusiasm and energetic work is largely responsible for the whole movement.

2. The authorization by the Council of the Society for the appointment by the president of a development committee of the Society at the Illinois meeting in June, 1922.

3. Appointment of the committee by President Charles F. Scott, July 7, 1922: M. E. Cooley, J. H. Dunlap, D. C. Jackson, F. W. McNair and C. F. Scott, and the Secretary, Ex-Officio.

4. Report of the Development Committee submitted to the Council August 8, 1922, creating the Board of Investigation and Coördination.

5. Appointment of the following as members of the Board (September 29, 1922): J. H. Dunlap, 1 year; M. E. Cooley, 2 years; C. F. Scott, 3 years; F. W. McNair, 4 years; D. C. Jackson, 5 years; and the Secretary of the Society as Secretary of the Board.

6. Conferences between members of the Board and different foundations looking to the granting of funds for the work.

7. Letter from Dr. Pritchett May 29, 1923, stating "I shall take pleasure in commending this project to the President of the General Educational Board and to the Adviser in Educational Research of the Commonwealth Fund, and I shall heartily recommend that the Carnegie Corporation participate in its support."

8. President F. P. Keppel of the Carnegie Corporation, on October 31, 1923, wrote Professor Charles F. Scott, Chairman of your Board of Investigation and Coördination, informing him that a sum of $108,000 has been "set aside for the purpose of making possible a study of engineering education under the direction of the Society for the Promotion of Engineering Education." This letter was reproduced in ENGINEERING EDUCATION, Vol. XIV, No. 3, and also in the small booklet "Aims and Purposes of the Society."

9. A meeting of the Board was immediately called for November 8, 1923, when the grant was accepted on behalf of the Society. At the same meeting, Mr. W. E. Wickenden was formally appointed, by the Board, Director of Investigations.

10. Mr. Wickenden devoted part of his time to the organization of the work from November 15, 1923, to January 1, 1924, when he severed all connections with his former work and devoted his entire time to this study.

11. At a meeting of the Board on November 8, 1923, it

voted to establish offices in the Engineering Societies Building, 33 West 39th Street, New York City.

12. It was decided to devote a part of each number of ENGINEERING EDUCATION to the work of the Board, this to be prepared and edited by Mr. Wickenden. The history of this movement from this time has been written in ENGINEERING EDUCATION.

At the meeting of the Board of Investigation and Coördination at Ithaca, during the annual meeting, it was voted to ask four national engineering societies to appoint councilors to coöperate with this Board. The following councilors have been appointed:

AMERICAN SOCIETY OF CIVIL ENGINEERS: J. Waldo Smith and F. C. Shenehon.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS: F. B. Jewett and Gano Dunn.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS: William Kelly and Allen H. Rogers.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS: John Lyle Harrington and Frank A. Scott.

In addition to the above the secretaries of these societies are coöperating with Mr. Wickenden.

The selection of Messrs. Aydelotte and Seashore as additional members of the Board in accordance with the suggestion from the Carnegie Corporation that others than engineering educators be placed on the Board.

The interest in the investigation being conducted by the Board has not only come to the attention of the Secretary through individual members of the Society, through other educational agencies and teachers, but also in a specific way from the institutions which are giving engineering instruction. This is reflected in the growth of the number of institutional members.

The Board met and presented its work at the meeting of the Division of Deans and Administrative Officers at the University of Michigan in January, 1924.

REPORT OF THE SECRETARY.

The activities of the Board will be covered in a separate report by the Director.

MEMBERSHIP.

The membership of the Society has shown a healthy growth during the past year under the direction of the Membership Committee, G. C. Schaad, University of Kansas, Chairman. The total membership on June 15, 1924, is 1832, resignations and deaths 82, new members—individual 173, institutional 20. I recommend that the same Membership Committee be continued for 1924–25.

DIVISION OF DEANS AND ADMINISTRATIVE OFFICERS.

The Division of Deans and Administrative Officers was authorized at the Illinois meeting in 1921, although a preliminary organization was affected at the Yale meeting. An invitation was extended by the University of Michigan to meet at Ann Arbor in 1923, but no meeting materialized. At the Cornell meeting under the direction of Dean W. G. Raymond, two sessions were held at which fine programs were provided. The next meeting of the Division was held at Ann Arbor on January 24–25, 1924, the University of Michigan having extended a very cordial invitation for this meeting. An intensive program under the chairmanship of Dean Arthur M. Greene of Princeton was arranged and carried out. Many items of especial interest to administrative officers were discussed. It was in every way a very successful meeting, 75 deans and administrative officers attending.

CHARLES A. COFFIN FELLOWSHIP AND RESEARCH COMMITTEE.

Past-President Charles F. Scott represented the Society as a member of this Committee. The Committee has available annually $5,000 supplied by the Coffin Foundation which was established by the General Electric Company. The Committee of three is composed of representatives of the American Institute of Electrical Engineers, the National Academy of Sciences and the Society for the Promotion of

Engineering Education. Its function is to make award of fellowship to graduates of American colleges desiring to continue research work in electricity, physics and physical chemistry. The first awards were made in May, 1923, to seven men who have been pursuing their work during the past year. In May, 1924, awards were made to eight men, two of whom had received awards the previous year. The selection was made from a total of twenty-nine applicants who propose to study during the coming year at the following universities: Chicago (2), Illinois, Johns Hopkins, Michigan, Princeton, Stanford and Yale. The amounts of the individual fellowships range from $500 to $1,000.

The representatives on the Committee are to be appointed by the organizations they represent. The Secretary of the Foundation writes as follows regarding appointments:

"Where possible the Foundation Committee has expressed its desire to have the Presidents of the three organizaions coöperating in the formation of the Charles A. Coffin Fellowship and Research Committee, designated as the representatives of the Societies Although this is a matter to be determined by the governing body of the Society."

Highway Education Board.

The Highway Education Board in addition to its usual activities has organized a movement which brought to this country from Latin-America, forty delegates to study highway engineering. The delegates were in most cases the leading highway engineer of the country from which they came. The program included meeting in Washington, tour of twenty days over the highways in different parts of the country. The Society is represented on this Board by your Secretary.

American Council on Education.

This Society is a member and has for its representatives, C. J. Tilden, Hugh Miller, and F. L. Bishop. The work of this organization will be presented to the Society by the Director, C. R. Mann, at this meeting.

Sections and Branches.

The report on this phase of the work of the Society will be presented by the Chairman, Dean H. S. Boardman, University of Maine. Dean Boardman is a Vice-President of the Society. The following sections and branches have reported this year:

New England Section,
Pittsburgh Section,
Minnesota Section,
Texas Section,
Vermont Branch,
Yale Branch,
Case Branch,
Purdue Branch,
Ohio Section,
Kansas-Nebraska Section,
Georgia Tech Section,
North Carolina Section,
New York Branch,
Maine Branch,
Stevens Institute of Technology Branch,
University of Colorado Branch.

Committees of the Society.

The work of the professional committees of the Society has been coördinated with the work of the Board of Investigation and Coördination through Mr. Wickenden, the Director of Investigations. These committees will serve as a unit in the study of engineering education now under way.

Constitution.

The Committee, consisting of Dean W. G. Raymond, Chairman, President Charles S. Howe, and Professor C. C. Williams, was appointed at the Cornell meeting to suggest revisions to the Constitution. The suggested revisions were published in the May number of Engineering Education and have been approved by vote of the Council. It will be presented to the meeting at this time for action.

Employment.

The Secretary's office has recommended twenty-five men for teaching or administrative positions this year. A number of notices of vacancies have been sent to the Secretary's office to which he could recommend no one. Several deans and other administrative officers have visited the office looking for men.

It would greatly facilitate this work if a larger number of men who desire to change their work or location should register with the Secretary.

Meetings with other Societies.

The Society during the past year has coöperated with the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Institute of Mining Engineers. In each case the men interested in education held a meeting usually in the form of a luncheon or dinner at which discussion of the investigation now being undertaken was presented by Mr. Wickenden. Several members of the Board have taken part in the discussion at these meetings.

An Appeal to the Members.

In the February number of Engineering Education Dean Thomas E. Mao of the National Southeastern University, Nanking, China, appealed to the members for books to replace in part their Engineering Reference Library which had been destroyed by fire. The response was very generous and two large boxes of books were sent.

Joseph A. Holmes Safety Association.

This Society is represented on the Joseph A. Holmes Association by O. P. Hood, Chief Mechanical Engineer of the Bureau of Mines, Washington, D. C. The association is a means of promoting safety in the mining industry, largely through educational methods, and as such is functioning successfully within the limits of its financial ability. The minutes of the last meeting, March 5, 1924, are on file in the office of the Secretary and will be sent to anyone interested.

Society Notes.

P. F. Walker, President of the Society, has represented us on the American Engineering Council.

A. A. Potter, Dean, Schools of Engineering at Purdue,

represented the Society at the fiftieth anniversary of the founding of that institution.

Anson Marston, Dean, Division of Engineering, Iowa State College, represented the Society on the Advisory Council of the American Engineering Council to coöperate in the movement for the establishment of Public Works Department in the national government.

Harold Pender, Professor-in-charge, Electrical Engineering, University of Pennsylvania, represented the Society at the dedication of the new Electrical Engineering Building at that institution.

F. L. Bishop, Dean, Schools of Engineering and Mines, University of Pittsburgh, represented the Society on the Highway Education Board. He is Chairman of the Executive Committee and Treasurer of the Board.

International Mathematical Congress.

This Congress will be held in Toronto and this Society has been asked to participate. The Committee on Mathematics—E. J. Berg, Chairman, J. A. Dent, D. C. Jackson, Jr., and H. W. Tyler—is coöperating with the Program Committee in securing papers from representative American educators.

Coöperation with the United States Bureau of Education.

This Society has continued its coöperation with the United States Bureau of Education, principally in the securing of accurate statistics in attendance at Engineering schools and in conjunction with Mr. Wickenden is making a study of typical curriculums of engineering schools covering several periods from 1860 to the present time.

Committee to Coöperate with Railroads.

The Society has been attempting for several years to organize effective coöperation with the railroads. This has been accomplished during the past year and the report of this Committee is published in the June number of Engineering Education.

Publications of the Society.

In the last Secretary's report occurred the following statement:

"The Society in its early years published a volume of Proceedings which was devoted exclusively to the papers and discussions at the annual meetings. In 1910, it began the publication of a monthly bulletin. Since that time, the Society has continued the regular publication of the volume of Proceedings and the Bulletin under the title of Engineering Education. In addition to this, it has published at different intervals various reports of committees, etc. There is submitted herewith a graph showing the constantly increasing cost of printing, it having practically doubled in the last eight years. Printing now absorbs more than half of the total income of the Society. The Secretary wishes to raise the question as to whether we shall continue all of these publications. If so, under what conditions?

"One solution is that followed by some of the national engineering societies; namely, to print all of the proceedings of our meetings, and the papers submitted for publication in Engineering Education and distribute this free to members. Those members who desire to pay a small additional fee would receive a bound volume containing the proceedings of the annual meeting, reprinted from Engineering Education."

Since that time the Committee on the Revision of the Constitution has voted to combine the annual proceedings with the bulletin under the title of "The Journal of the Society."

REPORT OF TREASURER, 1923-24.

Statement of Cash Account, June 17, 1924.

Balance on hand June 16, 1923		$ 886.58
Receipts:		
Current Dues	$ 7,608.00	
Back Dues	690.50	
Sales of Publications	1,105.62	
Advertising	1,591.25	
Dues paid in advance	64.00	
Interest, exchange, etc.	252.27	11,311.64
		$ 12,198.22

Disbursements:			
Cost of Publications	$ 2,792.02		
Expenses—Cornell University Meeting (1923)	678.23		
Honorarium for Secretary	80.00		
Clerical Assistance—Secretary's Office	1,650.00		
Expenses—President's Office	232.00		
Postage, Expressage Telephone, Telegraph, Sundry Printing and Office Supplies	644.72		
1923–24 Expenses		$ 6.096.97	
Expenses—University of Colorado Meeting (1924)		100.00	
Payment of balance of 1922–33 Expenses		3,782.14	
Payment on account of indebtedness from years prior to 1921–22		1,548.00	11,527.11
Balance on Hand June 17, 1924			$ 671.11

INCOME AND EXPENSE ACCOUNT.

Expense.

Cost of BULLETINS	$ 4,081.74
Cost of *Proceedings* (Estimated)	1,544.40
Expenses—Cornell University Meeting	678.23
Honorarium for Secretary	1,000.00
Clerical Assistance—Secretary's Office	1,800.00
Expenses—President's Office	232.00
Postage, Expressage, Telephone, Telegraph, Sundry Printing and Office Supplies	701.04
Total	$ 10,037.41
Surplus for Year	1,106.83
	$ 11,144.24

Income.

Current Dues	$ 8,174.10
Sales of Publications	1,206.37
Advertising	1,511.50
Interest, Exchange, etc.	252.27
	$ 11,144.24

CHARLES A. COFFIN FOUNDATION FELLOWSHIPS AWARDED IN 1924.

Eight university men of high scholastic attainment and exceptional promise have been awarded university fellowships for research work during the year 1924–25 by the Charles A. Coffin Foundation, which was established by the General Electric Company in 1922.

This year's awards, which have just been announced, have been made to the following: Ralph D. Bennett, Union College and the University of Chicago; Ulric Bray, Emory University and Yale University; G. Howard Carragan, Rensselaer Polytechnic Institute and University of Chicago; Elliott W. Cheney, Dartmouth College and Brown University; R. Carvel Hensen, Baltimore Polytechnic Institute and Johns Hopkins University; Clarence T. Hesselmeyer, Leland Stanford Junior University; Alfred L. Dixon, University of Illinois; William L. Fink, University of Michigan. Fellowships were awarded to the last two named, last year, and are renewed for the coming year.

The research problems in which they will engage include the X-ray-quantum theory; equilibrium in the system alkali-carbon dioxide-water; the Zeeman affect on fluorine; insulation, with special reference to absorption; high voltage phenomena; electronic and thermodynamic effects at high temperature; structure of steel with effect of carbon concentrated.

The terms of the Charles A. Coffin Foundation, established by the General Electric Company, make provision for the annual award of the income from a sum set apart for that purpose for fellowships to graduates of universities, colleges and technical schools of the United States who have shown, by the character of their work, that they could with advantage undertake or continue research work in educational institutions either in this country or abroad. The fellowships are

given in the fields of electricity, physics and physical chemistry, and the committee having charge of the awards desires to give them to men who, without financial assistance, would be unable to devote themselves to research work. They carry a minimum allowance of $500, which allowance may be increased to meet the special needs of the applicants to whom they are awarded. The committee for the present year consists of Dr. John C. Merriam, representing the National Academy of Sciences; Harris J. Ryan, representing the American Institute of Electrical Engineers; Dr. Charles F. Scott, representing the Society for the Promotion of Engineering Education. W. W. Trench, Schenectady, N. Y., is secretary of the Foundation.

B. G. LAMME'S WILL AIDS ENGINEERING EDUCATION.

After providing bequests to the members of his family, the will of the late Benjamin G. Lamme, one of the foremost electrical engineers and chief engineer of the Westinghouse Electric and Manufacturing Company, makes provision for a number of engineering scholarships and awards to take care of students, technical teachers and engineers along certain electrical and mechanical engineering lines.

Provision has been made for the Society for the Promotion of Engineering Education or some other suitable organization which shall give a gold medal yearly to the chosen technical teacher for accomplishment in technical teaching or actual advancement in the art of technical teaching. A trust fund of $6,000 has been established for this purpose. Not more than $1,000 to be used in making a suitable die for the medal and the remainder to be deposited for interest. If the accumulated interest warrants, two medals may be awarded in one year.

Two scholarships are established by the will for the two most capable students in mechanical and electrical engineering courses at the Ohio State University, Columbus, Ohio, Lamme's Alma Mater, during their senior year. A trust fund of $15,000 has been set aside for this purpose.

A fund of $6,000 has been set aside for a gold medal to be awarded annually to graduates of one of the technical departments of Ohio State University for meritorious achievements in engineering or technical arts. Not more than $1,000 of the fund will be used in making a die and the remainder will be deposited for interest. Two medals may be awarded during a period of one year if the accumulated interest warrants it.

The will also provides a trust fund for which $6,000 has been set aside for the American Institute of Electrical Engi-

neers for a gold medal to be awarded annually to a member of that society for meritorious achievement in the development of electrical apparatus or machinery. Not more than $1,000 of the fund will be used in making a suitable die for the medal and the remainder will be deposited for interest. If the interest from the fund permits, two medals may also be awarded during a period of one year.

The splendid collection of Indian relics which Mr. Lamme had collected during his life time is given to the Ohio State University.

BOOK REVIEW.

The Study of Electricity by the Deductive Method. 110 pages 5 x 7½—46 illustrations and diagrams.

A text which will assist in the explanations of the "transmission of power by electricity." The analogy, "an endless flexible shaft, is very ably used, and the author in this way appeals to the imagination of the student in a way to stimulate interest.

The first part of the book is devoted to a review of magnetism and definitions. The working hypothesis is introduced in connection with Ohm's Law, electric batteries magnetic induction, the commutator, polyphase circuits, the condenser and measuring instruments. Chapters IX and X summarize the results of the foregoing chapters and solve some simple every day problems.

H. C. K.

NEW MEMBERS.

G. C. SHAAD,

University of Kansas, *Chairman* of Membership Committee.

DISTRICT No. 1.

DRURY, CHARLES W., Manager, Deloro Research Laboratories, Box 310, Welland, Ont.

WHIPPLE, CLYDE C., Assistant Professor of Electrical Engineering, Polytechnic Institute of Brooklyn, Brooklyn N. Y.

WILEY, CYNTHIA E., John Wiley & Sons, Inc., 440 Fourth Avenue, New York City.

DISTRICT No. 2.

GRIFFITH, DALZELL M., Instructor in Civil Engineering, Bucknell University, Lewisburg, Pa.

HUNT, PERCIVAL, Professor and Head, Department of English, University of Pittsburgh, Pittsburgh, Pa.

DISTRICT No. 3.

DAVIS, DAVID E., Professor of Mechanical Engineering, John B. Stetson University, De Land, Fla.

DISTRICT No. 4.

ANDERSON, HAROLD W., Instructor in Electrical Engineering, University of Kansas, Lawrence, Kans.

BOYCE, EARNEST, Associate Professor of Sanitary Engineering, University of Kansas, Lawrence, Kans.

MOREY, CHARLES W., President, Chicago Technical School, Chicago, Ill.

PATERSON, DONALD G., Professor of Psychology, University of Minnesota, Minneapolis, Minn.

DISTRICT No. 5.

HARVEY, FUGENE C., Assistant Chief Structural Engineer, Bridge Dept., City of Los Angeles, Calif.

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